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SYNOPSIS OF CROTON AND PHYLLANTHUS (EUPHORBIACEAE) IN WESTERN TROPICAL MEXICO

Grady L. Webster
Herbarium, Section of Plant Biology
University of California
Davis, California 95616

ABSTRACT. Preliminary to a treatment of *Croton* and *Phyllanthus* in the *Flora Novo-Galiciana*, discussions of species, with citation of specimens and keys where appropriate, are presented for western Mexico. Forty-seven species of *Croton* and 21 species of *Phyllanthus* are recognized for the area. A new subsection *Xalapenses* of *Croton* sect. *Cyclostigma* is described. Two species of *Croton* are described as new: *C. mcvaughii* and *C. stenopetalus*. As a result of the revision of the species of *Croton* sect. *Velamea* in western Mexico, *Croton mazapensis* var. *pacificus* is described as new, and the new combination *C. morifolius* var. *brandegeanus* is applied to the taxon generally referred to as *C. flavescens*. *Phyllanthus* sect. *Brachycladus* is described as new; its only local representative is *P. mickelii*. In *Phyllanthus* sect. *Paraphyllanthus*, five species are recognized from western Mexico, and *P. peninsularis* subsp. *novogalicianus* is described as new.

INTRODUCTION

During studies on the Euphorbiaceae for the *Flora Novo-Galiciana* (FNG) in collaboration with Dr. Rogers McVaugh, it has become evident that a considerable number of taxonomic and nomenclatural changes in *Croton* and *Phyllanthus*, including descriptions of new taxa, are needed. Discussion of taxonomic problems sometimes extends outside the boundaries of FNG, hence for this study the region delineated in the map by McVaugh (1993) has been expanded to include tropical western Mexico (south of 28°N), including all or portions of the states of Baja California Sur, Sonora, Sinaloa, Chihuahua (west of 107°W), Nayarit (including Islas Tres Marías), southwestern Durango and Zacatecas, Aguascalientes, Jalisco, Colima, and Michoacán. Representative specimens (at least one locality per state) are cited for each species recorded from this area; complete specimen citations will appear for species included in FNG (additional citations are sometimes given for species outside Nueva Galicia). Circumscriptions of the sections of *Croton* follow Webster (1993), although some modifications have been found necessary.

CROTON

Within western tropical Mexico, *Croton* is represented by 47 species including 12 varieties. These are referable to 15 sections as delimited by Webster (1993), although study of the FNG species has indicated that circumscription and composition of some sections must be modified; revised descriptions of sections (as represented in the neotropics) are given where needed.

Since the study of the Euphorbiaceae of Nueva Galicia by McVaugh (1961), the species of *Croton* in western Mexico have been reviewed by Wiggins for the Sonoran Desert (1964) and Baja California (1980); more recently Steinmann and Felger (1997) have treated the species in Sonora. Martínez Gordillo (1995) has described and illustrated the species of Guerrero, many of which also occur in FNG.

Key to the Sections of Croton in Western Mexico

1. Petals well developed in both ♂ and ♀ flowers; indumentum lepidote. 3. *Croton* sect. *Eluteria.*
1. Petals absent or greatly reduced in ♂ flowers; indumentum stellate or dendritic (rarely stellate-lepidote).
   2. Lower nodes of inflorescence with both ♂ and ♀ flowers; petiolar glands conspicuous; indumentum at least in part of dendritic hairs.
      3. Styles multifid; sepals of ♀ flowers glabrous adaxially. 1. *Croton* sect. *Cleodora.*
      3. Styles bifid; sepals of ♀ flowers stellate-pubescent adaxially. 2. *Croton* sect. *Cyclostigma* (subsect. *Cyclostigma*).
   2. Lower nodes of bisexual inflorescences with ♀ flowers only (if ♂ flowers present, then petiolar glands obsolete).
      4. Petals absent in both ♀ and ♂ flowers; indumentum stellate-lepidote. 15. *Croton* sect. *Drepadenium.*
      4. Petals present in ♂ flowers; indumentum usually stellate.
         5. Leaf blades deeply 3-lobed; receptacle (disk) of ♂ flower glabrous; seeds tetragonal. 14. *Croton* sect. *Astraea.*
         5. Leaf blades not deeply lobed; receptacle (disk) of ♂ flower usually copiously villose; seeds more or less ellipsoidal and compressed.
            6. Styles multifid; leaf blades without paired glands at base.
               7. Indumentum of leaves lepidote; sepals of ♀ flowers reduplicate-valvate. 13. *Croton* sect. *Argyroglossum.*
               7. Indumentum of leaves stellate (stellate-lepidote in *C. michaelii*); sepals of ♀ flowers not reduplicate.
                  8. Stipules well developed, >1 mm long.
                     9. Stipules entire, not glandular; leaf blades pinnately veined, without stalked glands. 5. *Croton* sect. *Anadenocroton.*
                     9. Stipules glandular-dissected; leaf blades triplinerved or palmately veined, with few to many stalked capitate glands. 11. *Croton* sect. *Adenophyllum.*
                  8. Stipules rudimentary, <1 mm long. 12. *Croton* sect. *Medea.*
            6. Styles bifid; leaf blades with or without paired glands at base.
               10. Leaf blades with paired glands at base of leaf or apex of petiole.
                  11. Sepals of ♀ flower markedly unequal; bracts with basal clusters of glands; stamens 8–10. 8. *Croton* sect. *Geiseleria.*
                  11. Sepals of ♀ flower subequal; bracts without basal clusters of glands; stamens 8–40.
                     12. Leaf blades coarsely double-dentate, 2–10 cm long; stamens 8–12. 4. *Croton* sect. *Corylocroton.*
                     12. Leaf blades entire to serrulate.
                        13. Leaf blades acuminate, rounded or cordate at base, 7–20 cm long, petioles 1–5 cm long; stamens 22–35. 2. *Croton* sect. *Cyclostigma* (subsect. *Xalapenses*).
                        13. Leaf blades obtuse or acute, obtuse or cuneate at base, 3–6 cm long, petioles 0.5–1 cm long; stamen number unknown. 6. *Croton* sect. *Cascarilla*
               10. Leaf blades eglandular at base (or glands not over 0.2 mm in diameter).
                  14. Fruiting pedicels 3–7 mm long, recurving; herbs; leaf blades entire. 9. *Croton* sect. *Gynamblosis.*
                  14. Fruiting pedicels less than 3 mm long, not recurving; herbs, shrubs, or trees; leaf blades entire or dentate.
                     15. Sepals of ♀ flower markedly unequal, margin laciniate. 10. *Croton* sect. *Julocroton.*
                     15. Sepals of ♀ flower equal or subequal, margin entire.
                        16. Stipules entire, not glandular; leaves stellate-pubescent, ovate to lanceolate. 7. *Croton* sect. *Velamea.*
                        16. Stipules glandular-dissected or leaves stellate-lepidote, linear. 12. *Croton* sect. *Medea.*

1. Croton section **Cleodora** (Klotzsch) Baillon, Étude Euphorb. 369. 1858.—LECTOTYPE, designated by Webster, 1993: *Cleodora sellowiana* Klotzsch [=*C. sphaerogynus* Baillon].

Our representative of this section, *Croton billbergianus* Müll. Arg., is the single Mexican representative of this otherwise mainly South American group. Although this species was placed only tentatively within sect. *Cleodora* (Webster 1993), further review indicates that this is indeed where it belongs.

1.1. Croton billbergianus subsp. **pyramidalis** (Donn. Sm.) G. L. Webster, Ann. Missouri Bot. Gard. 75: 1123. 1988. *Croton pyramidalis* Donn. Sm., Bot. Gaz. 35: 7. 1903.—TYPE: GUATEMALA. Alta Verapaz: Río Dolores near Cubilgüitz, *Türckheim 7974* (holotype: US!).

The two collections from a limited area in oak and pine woodlands (>1000 m) in the Sierra de Manantlán are the first records of this subspecies west of Oaxaca; it is not reported from Guerrero by Martínez Gordillo (1995).

SPECIMENS EXAMINED. JALISCO: Mpio. Cuautitlán, 1–2 km SW of Telcruz, *Vázquez & Zúñiga 4487* (IBUG, WIS); 2 km SE of Las Marías, *Santana et al. 5307* (IBUG, WIS).

2. Croton section **Cyclostigma** Griseb., Fl. Brit. W. Ind. 42. 1859.—TYPE: *Croton gossypiifolius* Vahl.

This large section of about 50 mainly neotropical species is poorly represented in FNG; the only typical species is *Croton draco* Schltdl. & Cham., in subsect. *Cyclostigma* (Griseb.) Müll. Arg. However, there are three aberrant species that lack bisexual lower cymules in the inflorescences but resemble species of sect. *Cyclostigma* in habit: *C. suberosus* Kunth in H. B. K., *C. xalapensis* Kunth in H. B. K., and *C. stenopetalus*; the last is here diagnosed as new. In order to accommodate these three species in sect. *Cyclostigma*, it seems best to create a new subsection for them; this now gives a total of four subsections, as indicated in the key.

KEY TO THE SUBSECTIONS OF CROTON SECTION CYCLOSTIGMA

1. Pistillate flowers distinctly pedicellate; leaves with petiolar glands; lower cymules of bisexual thyrses with ♂ flowers; stamens 10–150.
   2. Styles bifid; sepals of ♀ flowers not reduplicate-valvate; leaf blades palmately or pinnately veined, copiously stellate-pubescent or sparsely pubescent; stamens 15–65.
      3. Leaf blades palmately or pinnately veined, copiously stellate-pubescent; stamens 15–65. *Croton* subsect. *Cyclostigma.*
      3. Leaf blades pinnately veined, sparsely pubescent; stamens 15–20. *Croton* subsect. *Sampatik.*
   2. Styles multifid; sepals of ♀ flowers more or less reduplicate-valvate; leaf blades mostly palmately veined, copiously stellate-pubescent; stamens 10–150. *Croton* subsect. *Palanostigma.*
1. Pistillate flowers sessile or subsessile; leaves with or without petiolar glands; lower cymules of bisexual thyrses lacking ♂ flowers; stamens 12–35. *Croton* subsect. *Xalapenses.*

2-1. Croton subsection **Cyclostigma** (Griseb.) Müll. Arg., Linnaea 34: 81. 1865.—TYPE: *Croton gossypiifolius* Vahl.

2-1.1. Croton draco Schltdl. & Cham., Linnaea 6: 360. 1831.—TYPE: MEXICO. Veracruz: "in sylvaticis Papantlae," *Schiede 1127* (holotype: HAL; isotype: W!).

This is the only species of subsect. *Cyclostigma* in Mexico. It is the northernmost of the "sangre de drago" species, which exude red latex and range from Sinaloa and Veracruz south to Panama. In western Mexico *C. draco* occurs in arroyos or oak/pine forests, mostly above 800 m.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Mazatlán, 16 mi by road N of Chupaderos, *Webster & Breckon 15544, Webster & Lynch 17049* (DAV); Villa Unión, 1964, *Dickson* (UC).—NAYARIT: Mpio. Compostela, 28 mi by road SW of Tepic, *Webster & Breckon 15773* (DAV).—JALISCO: Mpio. Autlán de Navarro, Puerto Los Mazos, 10 mi SW of Autlán, *McVaugh 19558, 22275* (MICH), *Webster & Breckon 16031* (DAV).—COLIMA: Mpio. Comala, SW foothills of Nevado de Colima, *McVaugh 16117* (MICH).—MICHOACÁN: Mpio. Coalcomán, Sierra Naranjillo, *Hinton 13930* (LAM).

2-2. Croton subsection **Xalapenses** G. L. Webster, subsect. nov.—TYPE: *Croton xalapensis* Kunth in H. B. K.

Subsectio Xalapenses ab aliis subsectiones Cyclostigmatis differt cymulis infimis thyrsi tantum ♀, floribus ♀ sessilibus vel subsessilibus, glandulis petiolorum interdum exiguis vel nullis.

Subsection *Xalapenses* includes both Mesoamerican and South American species, such as *Croton pungens* Jacq., *C. chilensis* Müll. Arg., and *C. boliviensis* Müll. Arg. The total number of species will not be certain until sect. *Cyclostigma* is revised.

KEY TO SPECIES OF CROTON SUBSECTION XALAPENSES IN WESTERN MEXICO

1. Climber; petals of ♂ flowers linear-lanceolate, 4–4.5 mm long; stamens 22–27; petiolar glands 0.2–0.5 mm in diameter. 2-2.2. *C. stenopetalus.*
1. Erect shrubs; petals of ♂ flowers ovate-lanceolate to spathulate, 2.5–3.5 mm long; stamens 12–55; petiolar glands absent or ca. 1 mm in diameter.
   2. Petiolar glands ca. 1 mm in diameter; seeds rugose-ribbed; stamens 22–35. 2-2.1. *C. xalapensis.*
   2. Petiolar glands absent; seeds smooth; stamens 12–15. 2-2.3. *C. suberosus*

2-2.1. Croton xalapensis Kunth in H. B. K., Nov. gen. sp. 2: 85. 1817.—TYPE: MEXICO. Veracruz: Jalapa, *Humboldt & Bonpland* (holotype: P-HBK!).

The population in western Michoacán appears to be disjunct from those in eastern Mexico (Veracruz to Chiapas). *Croton xalapensis* is common in secondary forests from Mexico to Costa Rica, from near sea level to over 1000 m.

REPRESENTATIVE SPECIMENS. MICHOACÁN: Mpio. Coalcomán de Matamoros, Coalcomán, *Hinton 15899* (MICH); Mpio. Jungapeo, San José Purúa, *Hinton 13806* (MO).

2-2.2. Croton stenopetalus G. L. Webster, sp. nov.—TYPE: MEXICO. Jalisco: Mpio. Tolimán, Sierra de Manantlán, 1–1.5 km W of El Terrero, *Santana & DeNiz 4543* (holotype: IBUG 9335!; isotype: WIS!). Fig. 1.

Arbuscula monoica scandens, foliis lanceolatis acuminatis triplinerviis, trichomata stellata plusminusve adpressa; glandulae laminae minutae; petioli glandulosi; inflorescentiae 5–6 cm longae, ad basin floribus ♀ 1–3; flos ♀ pedicello 5–7.5 mm longo; petala lineari-lanceolata, 4–4.5 mm longa, minus quam 1 mm lata; stamina 22–27, filamentis glabris; sepala integra, 2.5–3 mm longa; styli bifidi.

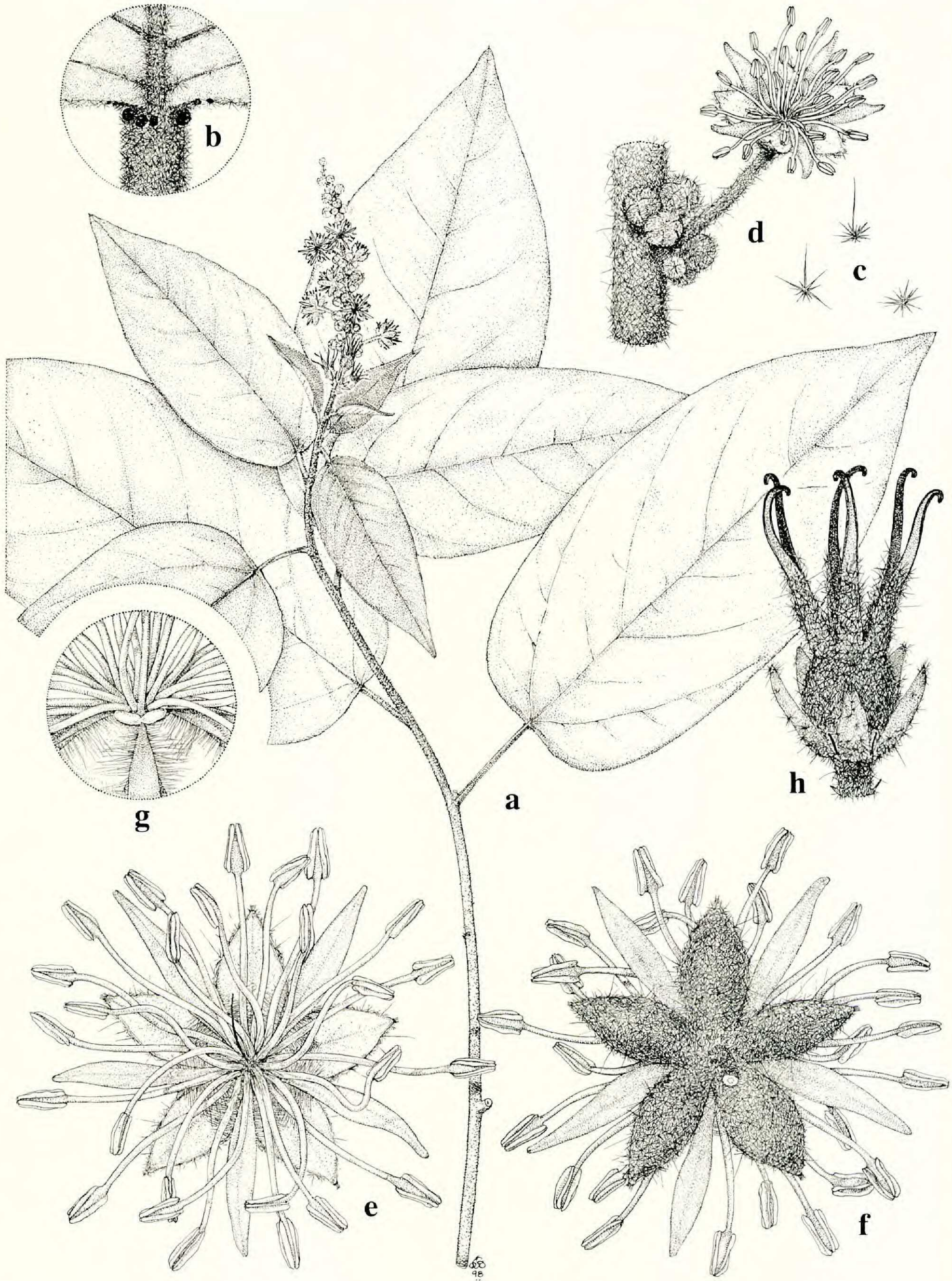

FIG. 1. *Croton stenopetalus*. A. Flowering branch, ×0.5. B. Rudimentary glands at base of leaf blade, ×10. C. Stellate-porrect trichomes, ×10. D. Staminate cymule with one open flower, ×2.5. E. Staminate flower, view from above, ×6. F. Staminate flower, view from below, ×6. G. Basal parts of stamens and petals, 10. H. Pistillate flower, ×6.

This rare species, known only from two collections in cloud forest at 2000–2200 m in the Sierra de Manantlán, is distinctive because of its scandent habit and the very narrow petals in the ♂ flower. It appears to be most similar to *C. xalapensis*, but in addition to its distinctive habit differs in its narrower and less densely pubescent leaf blades, which lack well-developed patelliform glands. Also, the ♂ flowers are borne on longer pedicels and have narrower petals.

ADDITIONAL SPECIMEN EXAMINED. JALISCO: Mpio. Tolimán, 3 km W of El Terrero, *Santana & Ceballos 4559* (IBUG).

2-2.3. Croton suberosus Kunth in H. B. K., Nov. gen. sp. 2: 86. 1817.—TYPE: MEXICO. Guerrero: Acapulco, *Humboldt & Bonpland 3862* (holotype: P-HBK!).

Croton cladotrichus Müll. Arg., Linnaea 34: 124. 1865.—TYPE: MEXICO. Unknown collector, "Herb. Pavón" (holotype: G!).

Croton purpusii Brandegee, Univ. California Publ. Bot. 6: 184. 1915.—TYPE: MEXICO. Oaxaca: San Gerónimo, *Purpus 7146* (holotype: UC!).

In general, *C. suberosus* resembles other species of sect. *Cyclostigma* in its large cordate leaves, elongate stipules, and dendritic indumentum; however, it lacks petiolar glands and bisexual cymules in the inflorescence, and it has smooth (rather than ribbed) seeds. Its position therefore must be regarded as anomalous. It is curious that this species, which extends along the Pacific Coast lowlands (elev. 300–400 m or less) to Guerrero and Oaxaca, has not been collected in Nayarit.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Escuinapa de Hidalgo, forest along MEX-15 ca. 11 mi N of Nayarit border, *Clarke et al. 1547-5* (DAV); Mpio. Mazatlán, N of Mazatlán, *Mexia 55, 1097*, *Shreve 7813* (MO).—DURANGO: Mpio. Toyaltita, 54 km SW de San Miguel de Cruces, *Tenorio & Romero 6247* (DAV; identity doubtful).—JALISCO: Mpio. La Huerta, 15 km NE of Juan Gil Preciado, *Flores et al. 2767* (DAV).—COLIMA: 10 mi S of Colima, *Webster & Breckon 16102* (DAV).—MICHOACÁN: Mpio. Aquila, 4 km E of Río Motín del Oro, *Tucker 2953* (CAS).

3. Croton section **Eluteria** Griseb., Fl. Brit. W. Ind. 39. 1859. *Croton* subg. *Eluteria* (Griseb.) Pax & Hoffm., Nat. Pflanzenfam. 3(5): 38. 1890.—TYPE: *Croton eluteria* (L.) Sw. (based on *Cluytia eluteria* L.).

This section is represented in Nueva Galicia by six species: *C. fantzianus* Seym., *C. guatemalensis* Lotsy, *C. niveus* Jacq., *C. pseudoniveus* Lundell, *C. reflexifolius* H. B. K., and *C. schiedeanus* Schltdl. They are readily distinguishable by the lepidote indumentum and well-developed petals in the ♀ flowers.

KEY TO THE SPECIES OF CROTON SECTION ELUTERIA IN WESTERN MEXICO

1. Leaf-blades pinnately veined; stamens 9–11, filaments glabrous; ovary lepidote. 3.1. *C. schiedeanus.*
1. Leaf-blades palmately veined; stamens 10–18, filaments glabrous or hirsutulous.
   2. Ovary stellate-tomentose; scales often porrect; fruiting pedicel 4–5 mm long. 3.2. *C. niveus.*
   2. Ovary lepidote; scales never porrect (except in *C. fantzianus*).
      3. Stamens 10 or 11; fruiting pedicel 1–2 mm long; leaf blades sparsely lepidote abaxially. 3.3. *C. pseudoniveus.*
      3. Stamens 13–18; fruiting pedicel 1–15 mm long or more; leaf blades densely lepidote abaxially.

4. Fruiting pedicel 1–3 mm long; bracts of ♂ flowers 2–2.5 mm long; scales sometimes porrect; seeds 7.5–8 mm long. 3.4. *C. fantzianus.*
4. Fruiting pedicel 5–12 (–15) mm long; bracts of ♂ flowers 0.5–2 mm long; scales never porrect.
   5. Inflorescences 8–22 cm long; fruits and seeds >10 mm long. 3.5. *C. guatemalensis.*
   5. Inflorescences not over 6 cm long; fruits and seeds less than 10 mm long. 3.6. *C. reflexifolius.*

3.1 Croton schiedeanus Schtdl., Linnaea 19: 243. 1847.—TYPE: MEXICO. Veracruz: Misantla, *Schiede 1126* (holotype: HAL!).

This species, widespread mainly in lowland rain forests on the Gulf side of Mesoamerica from Veracruz to Panama and northern South America, is very rare in western Mexico, where it is known only from two stations in Nayarit.

SPECIMEN EXAMINED. NAYARIT: Mpio. Compostela, 1–1.5 mi above Cucaracha, *McVaugh 19200* (MICH); Mpio. San Blas, 2 km W of Cora towards Jalcocotán, *Téllez 10057* (DAV, MEXU).

3.2 Croton niveus Jacq., Enum. Syst. Pl. 32. 1760.—TYPE: COLOMBIA. Cartagena, 1857, *Schott s.n.* (neotype, here designated: MO 1905037!).

Croton syringifolius Kunth in H. B. K., Nov. gen. sp. 2: 67. 1817.—TYPE: COLOMBIA. Bolívar: Turbaco, *Humboldt & Bonpland 1437* (holotype: P-HBK!).

Croton septemnervius McVaugh, Brittonia 13: 165. 1961.—TYPE: MEXICO. Colima: Manzanillo, *Palmer 1058* in 1890 (holotype: MICH!).

Although the synonymy of *C. niveus* is not extensive, this widespread Caribbean and Mesoamerican species has been confused with various other species of sect. *Eluteria*. Unfortunately, no specimen of Jacquin appears to have survived, and his original diagnosis of 1760 is very inadequate: "foliis ovato-cordatis, serrulatis, dorso tomentosis." In his book of 1763, Jacquin gave an illustration of a leaf and detailed description, which do seem to fit *C. niveus* as understood by most taxonomists.

In describing *Croton septemnervius* from FNG, McVaugh (1961) may have been misled by the treatment of Müller (1866: 518), who described the fruits of *C. niveus* as "lepidoto-puberulis" and those of *C. reflexifolius* as "molliter echinatis." In fact, under the name *C. septemnervius* McVaugh provided the first accurate illustration and description of the stellate ovarian trichomes of *C. niveus* contrasted with the lepidote ones of *C. reflexifolius* and other Mexican taxa of sect. *Eluteria*. Burger and Huft (1995) question the consistency of this stellate vs. lepidote ovarian character, but examination of many specimens of *C. niveus* and other related species suggests that it does hold, as accepted by Gómez-Pompa (1966) and Howard (1989).

Although *C. niveus* is widespread from Mexico (Tamaulipas) south through Central America and the West Indies to northern South America, it has not been recorded from Michoacán, Nayarit, and Sinaloa. Usually it grows in lowland deciduous tropical woodland below 300 m, but occasionally ascends to nearly 1000 m.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. La Huerta, Rancho Cuixmala, *Guadalupe Ayala 1208*, *Lott et al. 3645, 3700* (MICH, MO); Mpio. Cihuatlán, Playa de Cuastecomate, 8 km NW of Navidad, *McVaugh & Koelz 1698* (MICH).—COLIMA: Mpio. Manzanillo, 14 mi WNW of Santiago, *McVaugh 20765* (MICH).

3.3. Croton pseudoniveus Lundell, Phytologia 1: 449. 1940.—TYPE: MEXICO. Sinaloa: Mpio. Rosario, Los Labrados, *Mexia 921* (holotype: MICH!; isotype: UC!).

Recorded from Sonora south to Panama, this species is especially common in tropical deciduous woodlands along the Pacific lowlands (to 500 m) from Jalisco to Chiapas; curiously, it is unrecorded from Nayarit.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Culiacán, Baila, Abuya, *González Ortega 6567* (GH); Mpio. Pericos, Cerro Tecomate, *Gentry 5722* (GH); Mpio. Mazatlán, Mazatlán, *González Ortega 2027* (MO).—JALISCO: Mpio. La Huerta, Rancho Cuixmala, *Lott 2862* (MICH, MO).—COLIMA: Mpio. Colima, 10–11 mi S of Colima, *McVaugh & Koelz 1051* (MICH), *Webster & Breckon 16094* (DAV, MICH).

3.4. Croton fantzianus Seymour, Phytologia 43: 171. 1979.—TYPE: NICARAGUA. Nueva Segovia: Dipilto, *Budier 6390* (holotype: FLAS; isotypes: DAV! MO! UC!).

This species, which superficially resembles *C. pseudoniveus*, has been misidentified throughout much of its range. It occurs sporadically (below 1000 m) from Sonora to Oaxaca and then is disjunct to Nicaragua and Costa Rica, although it will probably be collected in northern Central America. It clearly differs from *C. pseudoniveus* in a number of characters, including bract size, number of stamens, and size of seeds. Apparently its closest relationship may be with *C. niveus*, with which it shares a porrect indumentum; however, it differs from that species in having more compact inflorescences, shorter fruiting pedicels, and larger seeds.

The distribution and characters of *C. fantzianus* suggest the possibility that it could be of hybrid origin following crosses between *C. niveus* and *C. pseudoniveus*. However, arguing against the hypothesis of a recent hybrid origin is the presence of the aberrant form of *C. fantzianus* in Sonora (Steinmann & Felger 1997), where *C. niveus* has not been collected.

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Alamos, Cerro la Calera, 12–14 km NW of Alamos, *Steinmann et al. 94-154*, *Van Devender et al. 93-334* (DAV).—JALISCO: Mpio. San Martín de Bolaños, 11 km NE of Bolaños, *Lott et al. 2108* (MEXU, TEX).

3.5. Croton guatemalensis Lotsy, Bot. Gaz. 20: 353. 1895.—TYPE: GUATEMALA. Santa Rosa: Santa Rosa, *Heyde & Lux 3035* (holotype: F!).

C. eluterioides Lotsy, Bot. Gaz. 20: 352. 1895.—TYPE: GUATEMALA. Santa Rosa: Santa Rosa, *Heyde & Lux 3470* (holotype: F!).

C. pyriticus Croizat, J. Arnold Arb. 26: 186. 1945.—TYPE: COSTA RICA. Cartago: El Alto RR station on road to Cartago, *Allen 661* (holotype: A!).

C. wilburi McVaugh, Brittonia 13: 166. 1961.—TYPE: MEXICO. Jalisco: 10 mi S of Autlán, *Wilbur & Wilbur 2431* (holotype: MICH!).

The large-fruited North American species of sect. *Eluteria* that occur in cloud forests above 1500 m have been poorly understood, partly because material with both flowers and fruits is usually necessary for identification. Croizat (1942) regarded *C. guatemalensis* and *C. eluterioides* as different species, with the latter being distinguished by larger rugose fruits. Croizat (1945) later described the large-fruited form as *C. pyriticus*, but provided no distinguishing characters. Standley and Steyermark (1949) placed *C. eluterioides* in synonymy under *C. guatemalensis*; this is a rather unfortunate choice, because as pointed out by Croizat

(1942), the type material of *C. guatemalensis* lacks fruits. There is therefore some ambiguity in the application of the name, but in the absence of any countervailing evidence, the decision of Standley and Steyermark is followed here.

The plants in Nueva Galicia, named *C. wilburi* by McVaugh (1961), are distinctive in their larger coarser leaves, but in both flowers and fruits agree with *C. guatemalensis*. Whether *C. wilburi* can be recognized at a lower taxonomic level must await a critical revision of sect. *Eluteria*.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. Autlán, 9 km E of Casimiro Castillo, *Iltis & Santana 30114* (MICH).—COLIMA: Cerro Grande, 3.5 km SW of El Terrero, *Cochrane et al. 11746* (IBUG, WIS).

3.6. Croton reflexifolius Kunth in H. B. K., Nov. gen. sp. 2: 68. 1817.—TYPE: MEXICO. "In maritimis prope Acapulco," *Humboldt & Bonpland* (holotype: P-HBK!).

As construed here, *C. reflexifolius* is widespread in Mexico and perhaps occurs in Guatemala as well. It has been confused with both *C. niveus* and *C. guatemalensis*. Although it is usually readily distinguished from *C. niveus* by its lepidote ovarian scales and lack of porrect trichomes, the populations in Tamaulipas closely mimic that species in general aspect. *Croton reflexifolius* is less easily differentiated from *C. guatemalensis*, as pointed out by Burger and Huft (1995). There seems to be an ecological difference between the species; *C. reflexifolius* occurs mainly in drier forests below 1000 m and *C. guatemalensis* mostly in cloud forests above 1000 m. Yet, as indicated by Gómez-Pompa (1966), some collections from above 1000 m in Guatemala appear to be referable to *C. reflexifolius*. Clearly, more critical study of specimens in Chiapas and Guatemala is needed.

REPRESENTATIVE SPECIMEN. JALISCO: Mpio. La Huerta, Estación Biológica Chamela, *McVaugh 26256* (MICH).

4. Croton section **Corylocroton** G. L. Webster, Taxon 42: 806. 1993.—TYPE: *Croton corylifolius* Lam.

This relatively small group of a half dozen Caribbean species is very close to sect. *Ocalia*, and both sections may be regarded as the American equivalents of the Old World sect. *Croton*. There are two species in western Mexico.

KEY TO SPECIES OF CROTON SECTION CORYLOCROTON IN WESTERN MEXICO

Fruiting pedicel 1–1.5 mm long; inflorescence with 3–7 ♀ flowers; seeds 2.9–3.3 mm long. 4.1. *C. mcvaughii*.

Fruiting pedicel 3–5 mm long; inflorescence with 1 or 2 ♀ flowers; seeds 4 mm long. 4.2. *C. repens*.

4.1. Croton mcvaughii G. L. Webster, sp. nov.—TYPE: MEXICO. Jalisco: Mpio. Cabo Corrientes, 5 km N of El Tuito, *McVaugh 25521* (holotype: MICH!).

Arbuscula monoica 0.7–1.5 m alta; foliis ovatis vel ovato-lanceolatis, 3–9.5 cm longis, 2–5.5 cm latis, petiolis 3–9 mm longis; inflorescentiae 3–5 cm longae, ad basin floribus ♀ 3–7; pedicelli fructiferi 1–1.5 mm longi; semina 2.9–3.3 mm longa.

It is highly appropriate to dedicate a new species to Rogers McVaugh, whose previous study of *Croton* in Nueva Galicia was an indispensable reference for the treatment in FNG. Although closely related to the widespread *C. repens*, *C. mcvaughii*

differs in its larger more pointed leaves, inflorescence with 3–7 (instead of 1 or 2) ♀ flowers, and smaller seeds. It has been recorded from oak woods and mixed broadleaf montane forest at 200–300 m.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. San Blas, 5 km NE of Miramar, *Téllez 9772* (DAV).—JALISCO: Sierra las Vigas, San Juan Casalá, *Machuca Núñez 4456* (WIS); Mpio. Jocotepec, Cerro Viejo, Zapotitán de Hidalgo, *Machuca Núñez 6375* (MICH).

4.2. Croton repens Schltdl., Linnaea 19: 237. 1847.—TYPE: MEXICO. Veracruz: Hacienda de La Laguna, *Schiede 40* (holotype: B, destroyed; lectotype, here designated: HAL!).

Although placed in sect. *Cascarilla* by Webster (1993), this species seems to fit sect. *Corylocroton* by virtue of its coarsely dentate, palmately veined leaves. It is widespread in oak savannas from Nayarit to Central America, mostly at elevations below 1000 m.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Nayar, 1 km N of Mesa de Nayar, *Steinmann 1062* (DAV); Mpio. San Blas, 2–9 mi W of Jalcocotán, *McVaugh & Koelz 694* (MICH).—JALISCO: Mpio. Zapopan, 10 km N of Tesistán, *Cházaro & Flores 6303* (TEX).

5. Croton section **Anadenocroton** G. L. Webster, Taxon 42: 806. 1993.—TYPE: *Croton axillaris* Müll. Arg.

Section *Anadenocroton* comprises nine or ten species, occurring from western Mexico to northern South America, and is represented by two species in western Mexico.

KEY TO THE SPECIES OF CROTON SECTION ANADENOCROTON IN WESTERN MEXICO

Inflorescences terminal; leaf blades obtuse to rounded at base, stipules 0.5–1 mm broad (not foliose). 5.1. *C. acapulcensis.*

Inflorescences axillary; leaf blades ± cordate at base, stipules foliose, 1–2.5 mm broad. 5.2. *C. alamosanus.*

5.1. Croton acapulcensis Martínez Gordillo & J. Jiménez-Ram., Anales Inst. Biol. Univ. Nac. Autón. México, Bot. 60: 40. 1990.—TYPE: MEXICO. Guerrero: Mpio. Acapulco, Parque Nacional "El Veladero," *Noriega 599* (holotype: FCME; isotype: MEXU).

This species resembles *C. sutup* Lundell from eastern Mexico, but differs in its larger stamen number and shorter fruiting pedicels. Martínez Gordillo (1995) recorded *C. acapulcensis* only from Guerrero, but specimens collected in lowland deciduous woodlands of coastal Jalisco appear to represent this species.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. La Huerta, Estación Biológica Chamela, *Ayala & Lott 24, Lott 3836* (DAV, MICH), *Gentry & Woodruff 74399* (MO).

5.2. Croton alamosanus Rose, Contr. U.S. Nat. Herb. 1: 111. 1891.—TYPE: MEXICO. Sonora: Alamos, *Rose 742* (lectotype, here designated: US!).

Croton blasianus M. E. Jones, Contr. W. Bot. 18: 49. 1933.—TYPE: MEXICO. Sinaloa: San Blas, *Jones 23304* (holotype: POM).

Croton alamosanus is common in the deciduous thorn scrub of the Pacific lowland of western Mexico and sympatric with *C. acapulcensis* in the Chamela area. It is easily distinguished from *C. acapulcensis* by its foliose stipules, dioecious populations, and axillary inflorescences. It seems closer to *C. axillaris* Müll. Arg., a Gulf Coast species distributed from Veracruz to Nicaragua. Usually the latter species may be separated by its leaves with longer petioles and non-foliose stipules.

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Alamos, Arroyo Las Rastras, *Van Devender et al. 93-1463* (DAV).—SINALOA: Mpio. Guamúchil, 10 mi N of Guamúchil, *Dressler 976* (MO); Mpio. Culiacán, Altata, *Gentry 5442* (MICH, MO); Mpio. Mazatlán, vicinity of Mazatlán, *Wright 1250* (MO).—NAYARIT: Mpio. Nayar, Los Sabinos, *Lomelí Sención 2116* (DAV).—JALISCO: Mpio. La Huerta, Estación Biológica Chamela, *Bullock 1272*, *Lott 1102* (DAV, MICH).—MICHOACÁN: Mpio. Aquila, Titzupan, *Hinton 13824* (DAV, GH, MO).

6. Croton section **Cascarilla** Griseb., Fl. Brit. W. Ind. 38. 1859. *Cascarilla* Adans., Fam. pl. 2: 355. 1763.—TYPE: *Croton cascarilla* (L.) L. (based on *Cluytia cascarilla* L.).

It is indicative of the biogeographic distinctiveness of the taxa of *Croton* in western Mexico that there is only a single local species belonging to the largest neotropical section.

6.1. Croton ortegae Standl., Field Mus. Publ. Bot. 22: 35. 1940.—TYPE: MEXICO. Sinaloa: Mpio. Mazatlán, Loma Atravesada, *Ortega 7019* (holotype: F-670991!; isotype: US!).

This apparently rare species is known only from the type collection, and no ♂ flowers have been seen. Its systematic position, therefore, remains problematical. Specimens of *C. culiacanensis* Croizat appear similar, but differ in smaller fruiting calyces with finer tomentum, and lack stipitate glands at the base of the leaf blade.

7. Croton section **Velamea** Baillon, Adansonia I, 4: 316. 1864.—LECTOTYPE, designated by Webster, 1993: *Croton campestris* A. St.-Hil.

With nine species and several varieties, sect. *Velamea* is the largest and most complex group of *Croton* within FNG. It also presents the greatest number of taxonomic difficulties. There are evidently two species groups, which (pending a revision of all North American species of sect. *Velamea*) are not given formal designation at this time: Group 1, with entire leaves often copiously pubescent abaxially; and Group 2, with dentate sparsely pubescent leaves.

Group 1 includes a variety of forms that have mostly passed under the names *Croton flavescens* Greenm., *C. fragilis* H. B. K., *C. morifolius* Willd., *C. rzedowskii* M. Johnston, and *C. sphaerocarpus* H. B. K. Prolonged study of this complex suggests that most plants in FNG are referable to two polymorphic species, *C. morifolius* Willd. and *C. roxanae* Croizat. The relationship of the plants in Baja California with those on the mainland remains rather problematic, but it appears that *C. caboensis* and *C. magdalenae* may be the only species confined to Baja California (and offshore islands).

Key to the Species of Croton Section Velamea in Western Mexico

1. Twigs stiffly hispid (hairs 2–2.5 mm long); leaf blades entire, strigose adaxially, appressed-stellate abaxially; pedicel and calyx of ♂ flowers stellate-pubescent. 7.8. *C. tremulifolius.*
1. Twigs appressed-stellate to hirsute or hispid (but then hairs less than 2 mm long); leaf blades entire or dentate, strigose or stellate-pubescent adaxially, appressed-stellate to tomentose abaxially; pedicel and calyx of ♂ flowers glabrous to pubescent.
   2. Leaves irregularly dentate, cordate, thick, copiously stellate-pubescent; stipules obscure; seeds 6–7 mm long. 7.3. *C. magdalenae.*
   2. Leaves entire, rounded to cordate at base, thin, sparsely to copiously pubescent; stipules absent to prominent; seeds often less than 6 mm long.
      3. Stipules subulate, (1–) 2–5 mm long; pedicel and calyx of ♂ flowers stellate-pubescent; leaf blades with the apex ± abruptly cuspidate or acuminate (acumen 1–2 cm long), often with a subulate mucro, generally with the base cordate; petioles mostly >1 cm long; inflorescences mostly at least 5 cm long. 7.2. *C. morifolius.*
      3. Stipules rudimentary or absent; pedicel and calyx of ♂ flowers stellate-pubescent to almost glabrous; leaf blades rarely with the apex abruptly cuspidate or the base cordate; petioles mostly <1 cm long; inflorescences mostly <5 cm long.
         4. Pedicel and calyx of ♂ flowers stellate-pubescent.
            5. Leaf blades stellate-pubescent adaxially, stellate-tomentose abaxially; seeds 4.2–5.2 mm long. 7.1. *C. mazapensis.*
            5. Leaf blades stellate-pubescent or ± strigose adaxially, stellate-pubescent abaxially, never tomentose; seeds mostly 5 mm long or more.
               6. Receptacle of ♂ flowers glabrous or nearly so; petioles glabrous to stellate-pubescent, not porrect-hispid; seeds 5–5.8 mm long; leaf blades stellate-pubescent adaxially. 7.5. *C. sonorae* [variant with pubescent ♂ pedicels].
               6. Receptacle of ♂ flowers moderately villose; petioles ± porrect-hispid; seeds 5.5–6.5 mm long; leaf blades ± strigose adaxially. 7.6. *C. caboensis.*
         4. Pedicel of ♂ flowers glabrous or nearly so; calyx of ♂ flowers glabrous to sparsely stellate.
            7. Leaf blades lanceolate, entire, ± attenuate-acuminate.
               8. Leaf blades glabrescent adaxially, strigose when young; twigs sparsely stellate to nearly glabrous; lower nodes of inflorescence often with ♂ flowers accompanying the ♀ flowers; seeds 3.8–4.6 mm long. 7.4. *C. roxanae.*
               8. Leaf blades stellate-scabrid adaxially; twigs densely porrect-hispid; lower nodes of inflorescence with ♀ flowers only; seeds 5–6.5 mm long. 7.5. *C. sonorae.*
            7. Leaf blades ovate to elliptic, denticulate or coarsely dentate, obtuse or acute to abruptly acuminate.
               9. Twigs appressed-stellate (stellate-tomentose on autumn twigs); leaf blades denticulate, petioles mostly 1–2 cm long; stamens 10 or 11; styles 4–6 mm long, glabrous. 7.7. *C. adspersus.*
               9. Twigs glabrous; leaf blades coarsely dentate, petioles mostly 3–7 cm long; stamens 13–15; styles ca. 3 mm long, sparsely stellate. 7.9. *C. ynesae.*

Group 1. Leaves on flowering axes entire; stipules relatively well developed (0.5–3 mm long).

7.1. Croton mazapensis Lundell, Contr. Univ. Michigan Herb. 7: 19. 1942.—Type: Mexico. Chiapas: between Mazapa and Motozintla, *Matuda 4834* (holotype: MICH!).

This species is morphologically very similar to *C. morifolius*; there appear to be no consistent differences in the reproductive stuctures. *Croton mazapensis* is sympatric with *C. morifolius* over large areas, but appears to grow in generally drier habitats. It seems expedient, therefore, to maintain it as a distinct species. Studies of the FNG specimens indicate that two varieties can be distinguished.

7.1a. Croton mazapensis var. **obtusifolius** (Müll. Arg.) G. L. Webster, comb. nov.
Croton morifolius var. *obtusifolius* Müll. Arg. in DC., Prodr. 15(2): 641. 1866.—TYPE: MEXICO. Oaxaca, *Andrieux 109* (holotype: G).
Croton gonzalezii Greenm., Proc. Amer. Acad. Arts 39: 81. 1903.—TYPE: MEXICO. Jalisco: Mpio. San Juan Bautista Cuicatlán, Cuicatlán, *V. González 980* (holotype: GH!).
Croton rzedowskii M. C. Johnston, Brittonia 20: 227. 1968.—TYPE: MEXICO. San Luis Potosí: Rioverde to San Ciro, *Rzedowski 4543* (holotype: MICH!).

When he described *C. rzedowskii*, Johnston (1968) commented that it was close to *C. mazapensis*. This seems evident, and it appears better to regard *C. rzedowskii* as an allopatric variety distinguished by a few characters, such as shorter inflorescences with a smaller number of ♀ flowers. This variety barely enters the FNG area in upland savannas in Zacatecas, at 1500–2000 m.

REPRESENTATIVE SPECIMENS. ZACATECAS: Mpio. Jalpa, 5 mi SW of Jalpa, *McVaugh 18503*, *Rzedowski 14205* (MICH).

7.1b. Croton mazapensis var. **pacificus** G. L. Webster, var. nov.—TYPE: MEXICO. Jalisco: Mpio. La Huerta, Cerro Pedregoso, *Pérez J. 1809* (holotype: DAV!).

Croton mazapensis var. pacificus ab var. obtusifolio differt ramulis non hirtellis, foliis acutis non mucronulatis.

In contrast to var. *obtusifolius*, which is found in open grassy terrain at much higher elevations (1500 m and above), var. *pacificus* appears to be restricted to lowland (<100 m) deciduous scrub or woodland. So far, there are only a few known collections of var. *pacificus*, all from the coast between southwestern Jalisco and Mazatlán (Sinaloa).

A remarkable specimen from near Mazatlán (*Eyerdam & Beetle 8683*, UC) probably represents var. *pacificus*, although the leaf blades are glabrous adaxially and tomentose abaxially, as in the eastern Mexican *Croton cortesianus* Kunth; however, the Sinaloan specimen differs from that species in its bisexual inflorescences and appressed stem pubescence. It may be an aberrant form of var. *pacificus*, but needs further study in the field.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. La Huerta, Cumbres de Cuixmala, El Salto, *Acevedo 998* (DAV).—SINALOA: hill of wireless station, Mazatlán, *Ferris 50006* (DS); Mpio. Mazatlán, Mazatlán, *Howell 10547* (CAS).

7.2. Croton morifolius Willd., Sp. pl. 4: 535. 1805.—TYPE: VENEZUELA: Cumaná, *Humboldt & Bonpland* (holotype: B-W-17854!).

This common species extends from the Pacific and Gulf coastal slopes of Mexico to northern Colombia and Venezuela. It occurs in seasonal forest and scrub, and sometimes reaches cloud forest above 1000 m. In Mexico, there are three varieties, all represented in the FNG area. One or more of these taxa have been recognized as distinct species (e.g., by Martínez-Gordillo 1995), and their rank is still subject to investigation. I believe that because there are indications of intergradation among the three, they are best treated as varieties.

KEY TO THE VARIETIES OF CROTON MORIFOLIUS

1. Twigs appressed-stellate (dendritic hairs rare or absent); ovary and capsule rounded or angled, indumentum of ovary whitish or yellowish.
   2. Ovary and capsule distinctly angled. 7.2a. *C. morifolius* var. *brandegeanus.*
   2. Ovary and capsule rounded. 7.2b. *C. morifolius* var. *morifolius.*
1. Twigs floccose with stipitate-stellate and dendritic hairs; ovary and capsule rounded, indumentum ± brownish. 7.2c. *C. morifolius* var. *sphaerocarpus.*

7.2a. Croton morifolius var. **brandegeanus** (Croizat) G. L. Webster, comb. nov.

Croton flavescens var. *brandegeanus* Croizat, J. Arnold Arb. 26: 187. 1945.—TYPE: MEXICO. Sonora: 4 mi N of Nacori, *Wiggins & Rollins 391* (holotype: A!).

Croton flavescens Greenm., Proc. Amer. Acad. Arts 39(5): 81. 1903.—TYPE: MEXICO. Michoacán: Monte León, *Pringle 8667* (holotype: GH!).

Although mature specimens of var. *brandegeanus* are very easily recognized by the angular ovaries and fruits, vegetatively the plants are almost indistinguishable from var. *morifolius*. In general, var. *brandegeanus* occurs further to the north and west in Mexico than the other two varieties; it occurs in a surprisingly wide range of habitats, from tropical deciduous forest to cloud forest, at elevations of 150–1600 m. In the FNG area, it is to some extent sympatric with var. *sphaerocarpus*, but the two have not been found at the same locality.

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Alamos, San Bernardo, *Gentry 1488* (UC).—CHIHUAHUA: Mpio. Batopilas, La Bufa, *Soulé 572* (MO); Areponapuchic, Barranca de Urique, *Knobloch 1341* (MICH).—SINALOA: Mpio. Culiacán, Culiacán, 18 Aug 1904, *Brandegee s.n.* (UC); Mpio. Rosario, El Monte, near Los Labrados, *Mexia 929* (MO).—NAYARIT: Mpio. Nayar, Jesús María, *Norris & Taranto 13948* (MICH).—ZACATECAS: Mpio. Moyhahua, San José, *Rzedowski 20252* (MICH).—JALISCO: Mpio. Tuxcacuesco, 5–6 km ENE of Zenzontla, *Santana & Benz 5907* (DAV, WIS).—MICHOACÁN: Mpio. Apatzingán, canyon below Acahuato, *Leavenworth & Hoogstraal 1545, 1550* (MO).

7.2b. Croton morifolius var. **morifolius**. *Croton morifolius* var. *genuinus* Müll. Arg., Linnaea 34: 125. 1865.

Croton sericeus Schltdl. & Cham., Linnaea 5: 85. 1830, non *Croton sericeus* Lam., 1786. *Croton deppeanus* Steud., Nomencl. Bot., ed. 2, 1: 446. 1840. *Croton fragilis* [var.] *sericeus* (Schltdl. & Cham.) Müll. Arg. in DC., Prodr. 15(2): 642. 1866.—TYPE: MEXICO. Veracruz: Plan del Río, *Schiede 59* (holotype: HAL!).

This is the most widespread of the varieties, occurring from eastern Caribbean Venezuela north to Nayarit and Veracruz. Generally, it is found in deciduous woodlands at lower elevations (usually below 1000 m) than the other two varieties. In the FNG area, it has been recorded in a few localities in Nayarit, Jalisco, and Colima. Specimens from Veracruz, including the type of *C. sericeus* Schltdl. & Cham., are distinctive in their larger leaves, often with an elongate apical mucro; it is possible that further study may demonstrate that they are varietally distinct.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Tepic, Colorado de la Mora, *Lomelí Sención 2062* (DAV).—JALISCO: Mpio. La Huerta, Cuixmala, Cerro de Alborada, *Castillo 5314* (DAV).—COLIMA: Mpio. Colima, 5 mi S of Colima, *McVaugh 15507* (MICH).

7.2c. Croton morifolius var. **sphaerocarpus** (Kunth in H. B. K.) Müll. Arg., Linnaea 34: 125. 1865. *Croton sphaerocarpus* Kunth in H. B. K., Nov. gen. sp. 2: 84, pl. 105. 1817.—TYPE: MEXICO. Michoacán: Volcán Jorullo, *Humboldt & Bonpland s.n.* (holotype: P-HBK!, fragment: A!).

Although it extends to Nayarit and Zacatecas, this variety occurs in gallery and tropical montane forests, generally at higher elevations (up to 1900 m) than the other two; it is the only variety found in the Sierra Madre Oriental in Querétaro, Puebla, and Hidalgo. A good argument could be made for recognizing it as a distinct species.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Ahuacatlán, 5–10 mi SE of Ahuacatlán towards Barranca del Oro, *Feddema 272, McVaugh 16359* (MICH).—JALISCO: Mpio. Tapalpa, El Salto, Río Jiquilpan, *Lott 374* (MICH).—COLIMA: Mpio. Comala, Rancho El Jabalí, 22 km NW of Colima, *Lott 2912, Vázquez 476, Sanders 10324* (MICH).—MICHOACÁN: Mpio. Sahuayo, 8 mi NW of Sahuayo, *McVaugh 18190* (MICH).—GUANAJUATO: Mpio. León, 4.5 km ENE of Alfaro, *Galván 3087* (MO).

7.3. Croton magdalenae Millsp., Proc. California Acad. Sci., ser. 2, 2: 220. 1889.—TYPE: MEXICO. Baja California Sur: Isla Magdalena, 17 Jan 1889, *Brandegee s.n.* (holotype: F; isotype: UC!).

Croton boregensis M. E. Jones, Contr. W. Bot. 18: 48. 1933.—TYPE: MEXICO. Baja California Sur: Laguna Mts., Borrego Ranch, *Jones 27496* (holotype: POM; isotype: UC!).

The most common woody *Croton* in Baja California, this species occurs from the Sierra Juárez south to Cabo San Lucas in lowland xeric scrub (from sea level to 700 m). It is similar in many ways to *C. morifolius*, but differs in its thicker ± obscurely dentate leaves, abaxially villose petals of ♂ flowers, and larger fruits and seeds. Plants on the islands in the Sea of Cortez have smaller, thicker leaves, but appear conspecific. Wiggins (1980) distinguished *C. boregensis* by its truncate rather than cordate leaf bases, but the leaves of the isotype are clearly cordate.

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA: Sierra Juárez, Cañón Diablito, *Webster 18264* (DAV).—BAJA CALIFORNIA SUR: Sierra de la Giganta, *Carter & Ferris 3886* (DAV, UC); Sierra de la Victoria E of Todos los Santos, *Chambers 887* (US); Cayuca Ranch, Loreto, *Jones 27498* (MO); W of Volcán Las Tres Vírgenes, *Webster 26163* (DAV). Isla del Carmen: Puerto Ballandra, *Wiggins 17507* (DAV, DS); Agua Grande, *Johnston 4143* (MO).

Steinmann and Felger (1997) reported *C. magdalenae* from Isla Tiburón, Sonora.

7.4. Croton roxanae Croizat, J. Arnold Arb. 21: 81. 1940.—TYPE: MEXICO. Nayarit: Islas Tres Marías, María Madre, *Ferris 5601* (holotype: A!; isotype: DS!).

Leaf blades elliptic to lanceolate, caudate-acuminate, glabrescent adaxially (often becoming almost glabrous in age); stipules obsolete; pedicels of ♂ flowers glabrous or nearly so; inflorescences often with bisexual lower cymules.

There has been more confusion about the identity of this common species than any other species of *Croton* in FNG. It occurs mostly in lowland deciduous woodlands, but sometimes reaches oak forest above 1000 m. Most of the collections here referred to *C. roxanae* have been identified as *C. fragilis* H. B. K. or *C. rhamnifolius* H. B. K., both based on types from South America. The type material of *C. fragilis* from Cumaná, Venezuela (*Humboldt 97*, P-HBK!) was described by

Kunth as having the upper leaf surface stellate rather than strigose and the twigs tomentose-pilose, characters that do not suggest the plants from FNG. Furthermore, the type collection of *C. fragilis* is so imperfect that the identity of the species must remain doubtful; there seems little justification for applying the name *C. fragilis* to Mexican plants. *Croton rhamnifolius* (syntypes from Prov. Sucre, Venezuela, *Humboldt* in Herb. Willdenow 17853, B) presents problems of a different nature. It seems probable that several different species are included in Müller's very broad circumscription of 1866. The type variety, *C. rhamnifolius* sensu stricto, has tomentose stems, the leaves more short-pointed, and ♂ flowers with a puberulent calyx and copiously villose receptacle (in contrast to the nearly glabrous receptacle of *C. roxanae*). It appears that the least unsatisfactory alternative is to apply the name *Croton roxanae* to this highly variable complex of populations in western Mexico. There frankly remains some doubt about the relationship between the rather poorly known plants from the Islas Tres Marías and those on the mainland.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Rosario, Los Labrados, *Ferris & Mexia 5242* (A).—NAYARIT: Mpio. San Blas, 12 mi NE of Singayta, *Webster & Lynch 17071* (DAV, MICH).—JALISCO: Mpio. La Huerta, Estación Biológica Chamela, *Bullock 932, Delgado 294, Lott & Ayala 29, Pérez 683* (MICH).—COLIMA: Mpio. Manzanillo, gorge of Río Cihuatlán 13 mi N of Santiago, *McVaugh 15837* (MICH).—MICHOACÁN: Mpio. Coalcomán de Matamoros, Coalcomán, *Hinton 13850* (MICH).

7.5. Croton sonorae Torrey in Emory, Rept. Bot. Mex. Bound. Surv. 194. 1859.—TYPE: MEXICO. Sonora: "Sierra de Nayos," Jul 1855, *A. Schott s.n.* (holotype: NY, photograph: DAV!).

Croton pringlei S. Watson, Proc. Amer. Acad. Arts 20: 373. 1885.—TYPE: MEXICO. Sonora: "northwestern mountains," *Pringle 569* (holotype: GH!; isotype: US!).

Croton attenuatus M. E. Jones, Contr. W. Bot. 18: 47. 1933.—TYPE: MEXICO. Baja California Sur: Sierra Giganta, Cayuca ranch, *Jones 27500* (holotype: RSA).

This species, common in the Sonoran Desert, is typically easy to recognize by its small rigid leaves with sparse scabrid indumentum. Larger-leaved forms, such as occur in Baja California, can mimic *C. roxanae* or forms of *C. mazapensis*. However, usually the pedicel of ♂ flowers is stellate-pubescent in *C. sonorae*, and the seeds are larger than in *C. roxanae*. The absence of *C. sonorae* from Sinaloa is unexpected, in view of its presence in Baja California Sur. It is also surprising that *C. sonorae* is sympatric with *C. caboensis* and *C. magdalenae* in Baja California Sur, but does not occur further north in the peninsula.

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA SUR: Sierra de la Giganta, S of Tinaja de Naucajoa, *Carter 4480* (DAV, UC); Mesa del Protrero de San Javier, *Carter 4963* (UC); 17 mi S of La Paz, *Webster & Murphey 24344* (DAV).—SONORA: Mpio. Guaymas, Punta Narizón, *Webster & Dehgan 19747* (DAV).

7.6. Croton caboensis Croizat, J. Arnold Arb. 26: 181. 1945.—TYPE: MEXICO. Baja California Sur: Todos Santos, 4 Oct 1899, *Brandegee s.n.* (holotype: UC!).

Croizat characterized this species as an outstanding segregate from the "group of *C. fragilis*" because of its strigose leaves, large seeds, and hispid ovary. These characteristics are indeed distinctive in separating it from *C. mazapensis* and *C. morifolius*. In semi-xeric deciduous woodlands and scrub in Baja California Sur *C. caboensis* is sympatric with both *C. magdalenae* and plants referred to *C. sonorae* by Annetta Carter.

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA SUR: Sierra de la Giganta, 3.5 km NE of San José de Agua Verde, *Carter 4834* (DAV, MO, UC); Cañón de la Cumbre, *Carter 4849* (MO, UC); San José del Cabo, *Brandegee 549* (UC).

GROUP 2. Leaves on flowering axes serrulate to coarsely dentate, stipules rudimentary.

In contrast to the taxa of Group 1, the species of Group 2 are restricted to northern Mesoamerica. *Croton adspersus* Benth. reaches Guatemala at its southern limit, *C. ynesae* Croizat is found from Jalisco to Guerrero, and *C. tremulifolius* Croizat is endemic to Colima. A character of possible systematic importance is the production of smaller densely tomentose leaves during the dry season in both *C. adspersus* and *C. ynesae*; possibly *C. tremulifolius* will show the same behavior. Apparently, comparable short-shoots with densely tomentose leaves do not occur in taxa of Group 1.

7.7. Croton adspersus Benth., Pl. Hartwegianae 51. 1840.—TYPE: MEXICO. Michoacán: Morelia, *Hartweg 389* (holotype: K!).

Croton calvescens S. Wats., Proc. Amer. Acad. Arts 26: 147. 1891.—TYPE: MEXICO. Jalisco: Chapala, *Palmer 706* in 1886 (holotype: GH!).

Croton botryocarpus Croizat, Field Mus. Publ. Bot. 22: 445. 1942.—TYPE: GUATEMALA. Jalapa: Jalapa, *Standley 77519* (holotype: A!).

Croton adspersus is widespread and common in oak-pine forests above 1500 m in the Sierra Volcánica Transversal, in Mexico from Jalisco to Chiapas and in Guatemala.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. Tapalpa, 1–2 mi E of Tapalpa, *McVaugh 20515* (MICH).—MICHOACÁN: Mpio. San José de Gracia, 6 km NE of San José, *Rzedowski 15504* (MICH); Mpio. Tancítaro, 2 mi S of Tancítaro, *Leavenworth 603* (MO); Mpio. Morelia, 16 mi E of Morelia, *Webster & Breckon 16142* (DAV).

7.8. Croton tremulifolius Croizat, J. Arnold Arb. 21: 83. 1940.—TYPE: MEXICO. Colima: hill between Cuyutlán Lagoon and the ocean, *Ferris 6176* (holotype: A!; isotype: CAS!).

Croton tremulifolius is rare in coastal deciduous woods below 100 m in southern Jalisco and adjacent Colima. An anomalous specimen (*Sanders 8472*) from Rancho Jabalí, Colima, lacks hispid stems.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. La Huerta, Playa Perula adjacent to Bahia Chamela, *Mayfield 1631* (DAV).—COLIMA: Mpio. Manzanillo, 5 km E of Manzanillo, *Díaz Luna 3324* (MICH); Playa Campos, 4–5 km S of Manzanillo, *Orcutt 4504* (CAS, MO).

7.9. Croton ynesae Croizat, J. Arnold Arb. 21: 83. 1940.—TYPE: MEXICO. Jalisco: Mpio. Puerto Vallarta, Santa Cruz de Vallarta, *Mexia 1279* (holotype: A!; isotype: MO!).

Croton ynesae occurs in mixed deciduous or oak forests at 300 to 1200 m from Nayarit to Guerrero.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Ruiz, between El Venado and Zopilote, *Breedlove & Almeda 45206, 60679* (CAS); Mpio. Santa María del Oro, lake NE of Santa María, *Feddema 753* (MICH), *Webster 19911* (DAV).—JALISCO: Mpio. Tecalitlán, 5 mi SW of Tecalitlán, *McVaugh 15451* (MICH).—COLIMA: Mpio. Minatitlán, 9 km NE of Minatitlán, *McVaugh 26235* (MICH).

8. Croton section **Geiseleria** (Klotzsch) Baillon, Étude Euphorb. 359. 1858.—TYPE: *Geiseleria chamaedryfolia* Klotzsch [=*Croton trinitatis* Millsp.].

There are five species of this section in western Mexico, two of them recently described. Steinmann (1998) pointed out that *C. cupuliferus* and his new species *C. martinianus* belong to sect. *Geiseleria*.

KEY TO THE SPECIES OF CROTON SECTION GEISELERIA IN WESTERN MEXICO

1. Leaf blades subentire.
   2. Shrub to 3 m, leaves stellate-lepidote abaxially; ♀ flowers appressed to inflorescence axis. 8.1. *C. chamelensis.*
   2. Perennial herb or subshrub less than 0.5 m; leaves stellate-lanate abaxially; ♀ flowers not appressed to inflorescence axis. 8.2. *C. varelae.*
1. Leaf blades coarsely dentate.
   3. Bracts subtending ♂ flowers <1 mm long, lacking bottle-shaped glands at base; sepals of ♀ flowers slightly unequal, linear to oblanceolate, the larger 2–2.5 mm long in fruit; leaf blades acuminate, strigose or appressed-stellate adaxially; seeds 3.5–4 mm long; scarcely woody shrub to 1 m high. 8.3. *C. cupuliferus.*
   3. Bracts subtending ♂ flowers at least 2 mm long, subtended by bottle-shaped glands; sepals of ♀ flowers distinctly unequal, linear to oblanceolate to spathulate, the larger >3 mm long in fruit; leaf blades obtuse to acute, stellate or tomentose on both faces; seeds 2.6–3.3 mm long; herbs mostly 0.5 m high or less.
      4. Perennials with appressed-stellate to tomentose stems; leaf blades sparsely to densely stellate-pubescent adaxially; receptacle of ♂ flowers densely villous; sepals of ♀ flowers oblanceolate to spathulate, the larger 3.5–4 mm long; seeds 3–3.3 mm long. 8.4. *C. martinianus.*
      4. Annuals with hirsute-hispid stems; leaf blades strigose adaxially; receptacle of ♂ flowers glabrous or nearly so; sepals of ♀ flowers linear to oblanceolate, the larger 4–6.5 mm long; seeds 2.6–3.1 mm long. 8.5. *C. hirtus.*

8.1. Croton chamelensis E. J. Lott, Brittonia 39: 302. 1987.—TYPE: MEXICO. Jalisco: Mpio. La Huerta, Estación Biológica Chamela, *Pérez Jiménez 1391* (holotype: MEXU; isotype: DAV!).

This species, with disjunct stations in Nayarit, Jalisco, and Guerrero, appears to be restricted to deciduous woodlands at low elevations (<200 m). *Croton chamelensis* appears very different from the other local species and is closely related to *C. ramillatus* Croizat of eastern Mexico.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Nayar, La Nopalera, *Flores-Franco 2799* (MICH).—JALISCO: Mpio. La Huerta, Estación Biológica Chamela, *Bullock* 1924, Lott *et al. 557, 1677, 1730* (MICH).

8.2. Croton varelae V. W. Steinm., Aliso 19: 182. 2001.—TYPE: MEXICO. Nayarit: Mpio. Nayar, 1 km N of Mesa de Nayar, *Steinmann et al. 1063* (holotype: RSA; isotype: DAV!).

Croton varelae is known only from the type collection gathered in oak-pine woods at 1300 m. This species appears very distinct from the other Mexican taxa of sect. *Geiseleria*.

8.3. Croton cupuliferus McVaugh, Brittonia 13: 163. 1961.—TYPE: MEXICO. Colima: Mpio. Manzanillo, 14 mi WNW of Santiago, *McVaugh 20771* (holotype: MICH!; isotype: DAV!).

Croton cupuliferus occurs in deciduous woodlands below 1000 m in Jalisco and Colima. This species is very similar in aspect to *C. martinianus*, but differs from that and the other species of sect. *Geiseleria* in the lack of bottle-shaped glands at the base of the bracts subtending the ♂ flowers. If it were not for its close resemblance to *C. martinianus*, it could be assigned to sect. *Corylocroton*.

REPRESENTATIVE SPECIMEN: JALISCO: Mpio. La Huerta, Chamela, Cerro Maderas, *Lott et al. 1829* (DAV, MICH).

8.4. Croton martinianus V. M. Steinm., Novon 8: 81. 1998.—TYPE: MEXICO. Sonora: Mpio. Alamos, Sierra de Alamos, 2 km SW of Alamos, *Steinmann 954* (holotype: ARIZ; isotype: DAV!).

Croton martinianus is found in tropical deciduous forest and oak woodland at 500–1200 m from southern Sonora to Jalisco. As noted by Steinmann (1998), there is dimorphism in leaf pubescence, the tomentose plants apparently developing during the dry season. This has not been noted in *C. cupuliferus*, unless the questionable specimens from northern Jalisco cited for *C. martinianus* really belong to *C. cupuliferus*.

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Alamos, 2 km SW of Alamos (topotype), *Steinmann 93-309* (DAV); Arroyo Gochico, ca. 10 km E of San Bernardo, *Steinmann et al. 606* (DAV).—SINALOA: Mpio. Salvador Alvarado, N of Terrero, *Bojórquez 688* (MEXU).—JALISCO: Mpio. San Cristóbal de la Barranca, 1 km NE of San Cristóbal, *Lomelí Sención 2010* (DAV); Mpio. Zapopan, 30 km N of Zapopan, *Rodríguez et al. 1416* (WIS).

8.5. Croton hirtus L'Her., Stirp. nov. 17, pl. 9. 1785. *Croton glandulosus* [var.] *hirtus* (L'Her.) Müll. Arg. in DC., Prodr. 15(2): 684. 1866. *Croton glandulosus* subsp. *hirtus* (L'Her.) Croizat, Bull. Torrey Bot. Club 75: 401. 1948.—TYPE: FRENCH GUIANA. *L. Richard s.n.* (syntypes: P-LA!; P-JU 16358!).

This widespread weed has often been confused with *C. glandulosus* L., which so far has not been encountered in western Mexico.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Culiacán, Culiacán, Sep 1904, *Brandegee s.n.* (UC).—JALISCO: Mpio. La Huerta, just N of La Huerta, *Wilbur 36715* (DUKE).—COLIMA: Mpio. Colima, Colima, *Palmer 37* in 1897 (MICH, UC).—MICHOACÁN: Mpio. Aquila, Playa Cocula, *Wilbur 36633* (DUKE).

9. Croton section **Gynamblosis** (Torr.) A. Gray, Manual, ed. 2, 392. 1856.—TYPE: *Croton monanthogynus* Michx.

9.1. Croton pedicellatus Kunth in H. B. K., Nov. gen. sp. 2: 75, pl. 104. 1817.—TYPE: PERU. Cajamarca: Pongo de Rentema, *Humboldt & Bonpland* (holotype: P-HBK).

Croton tenuilobus S. Wats., Proc. Amer. Acad. Arts 21: 439. 1886.—TYPE: MEXICO. Chihuahua: Hacienda San José, *Palmer 29* (holotype: GH).

McVaugh (1961) appears correct in including *C. tenuilobus* in *C. pedicellatus*, which is widespread in South America, but in North America is known only from western Mexico in thorn forests or woodlands.

Representative Specimens. Sonora: 9.7 mi by road S of Nuri, *Turner & Goldberg 77-26* (UC).—Nayarit: Mpio. Nayar, 32.5–40 km NE of Jesús María, *Flores & Tenorio 966, 1009* (DAV, MICH, MEXU).—Jalisco: Mpio. Chapala, 9 mi W of Chapala, *Webster & Lynch 17169* (DAV, MICH).—Michoacán: Mpio. Coalcomán de Matamoros, Coalcomán, *Hinton 12690* (MICH, UC).

10. Croton section **Julocroton** (Mart.) G. L. Webster, J. Arnold Arb. 48: 354. 1967. *Julocroton* Mart., Flora 20, Beibl. 2: 119. 1837.—Type: *Julocroton phagedaenicus* Mart. [= *Croton triqueter* Lam.]

Although *Julocroton* was reduced to a section of *Croton* over thirty years ago (Webster 1967), it is still treated by some as a distinct genus.

Key to the Species of Croton Section Julocroton in Western Mexico

Annual herb with silvery foliage; leaf blades rounded to acute at apex; bracts entire; petals of ♂ flower glabrous; disk of ♀ flower asymmetrically lobed. 10.1. *C. argenteus.*
Shrub, foliage with brownish hairs; leaf blades acute to acuminate at apex; bracts apically laciniate; petals of ♂ flower pubescent; disk of ♀ flower lunate, entire. 10.2. *C. conspurcatus.*

10.1. Croton argenteus L., Sp. pl. 1004. 1753. *Julocroton argenteus* (L.) Didr., Vidensk. Meddel. Dansk Naturh. Foren. Kjøbenhavn 1857: 134. 1857.—Type: specimen in the Hortus Cliffortianus Herbarium (holotype: BM!).

Croton argenteus ranges from southern Texas and Mexico to South America, but it is rare in western Mexico and apparently recently introduced there.

Representative Specimen. Jalisco: Mpio. La Huerta, 3 km W of Quémaro, *Guadalupe Ayala 916* (DAV).

10.2. Croton conspurcatus Schltdl., Linnaea 7: 380. 1832. *Julocroton conspurcatus* (Schltdl.) Klotzsch, Arch. Naturgesch. 7: 193. 1841. *Julocroton triqueter* var. *conspurcatus* (Schltdl.) Müll. Arg. in DC., Prodr. 15(2): 705. 1866.—Type: Mexico. Veracruz: Tioselo [Teocelo], *Schiede 39* (holotype: HAL).

Like *C. argenteus*, *C. conspurcatus* is common in eastern Mexico but rare and perhaps recently introduced into western Mexico.

Representative Specimens. Jalisco: Mpio. La Huerta, Cumbres de Cuixmala, El Salto, *Acevedo et al. 999* (DAV, WIS); Mpio. Tuxcacuesco, 5–6 l km ENE of Zenzontla, *Santana & Benz 5921* (DAV, WIS).

11. Croton section **Adenophyllum** Griseb., Fl. Brit. W. Ind. 40. 1859.—Type: *Croton adenophyllus* Spreng.

This section, characterized by stipitate glands on leaves, stipules, and sometimes calyces, is represented by five species in western Mexico. Except for the common *C. ciliatoglanduliferus*, the species are poorly sampled and inadequately understood.

Key to the Species of Croton Section Adenophyllum in Western Mexico

1. Leaf blades ovate to lanceolate, >1 cm broad; styles multifid; stamens 11–45.
   2. Leaf blades with copious stipitate marginal glands, tomentose abaxially; stipules dissected into gland-tipped cilia 2–5 mm long; stamens 25–45. 11.1. *C. ciliatoglanduliferus.*

2. Leaf blades with scattered (usually very sparse) stipitate marginal glands, sparsely stellate-pubescent abaxially; stipules dissected into cilia 0.5–2 mm long; stamens 11–15.
   3. Fruiting pedicel 4–5.5 mm long; seeds 5.2–5.6 mm long. 11.2. *C. jucundus.*
   3. Fruiting pedicel 1.5–3.5 mm long; seeds 3.7–4 mm long. 11.3. *C. subjucundus.*
1. Leaf blades linear, <1 cm broad; styles bifid; stamens 10–16.
   4. Leaf blades stellate-tomentose abaxially, margins often with stipitate glands; stipules glandular-dissected; bracts of ♂ flowers glandular-dissected; sepals of ♀ flowers with copious stipitate glands. 11.4. *C. yecorensis.*
   4. Leaf blades stellate-lepidote abaxially, margins without glands; stipules rudimentary; bracts of ♂ flowers subulate, glandular at base; sepals of ♀ flowers sparsely glandular. 11.5. *C. michaelii.*

11.1. Croton ciliatoglanduliferus Ortega, Nov. pl. descr. dec. 51. 1797 ("*C. ciliatoglanduliferum*"). *Croton penicillatus* Vent., Choix pl. 12, pl. 12. 1803, nom. superfl.—TYPE: based on living material cultivated at the Madrid Botanical Garden from seed sent by Sessé.—[MEXICO.] "Nueva Espana," *Sessé & Mociño s.n.* (neotype, here designated: G-Barbey-Boissier!).

This extremely common species, barely reaching southern Texas, is widespread in Mexico from Sonora and Tamaulipas to Chiapas and Quintana Roo, continuing into Central America. In Nueva Galicia, it is common in disturbed deciduous forest or scrub from sea level to 1800 m.

In the protologue, Ortega wrote "Habitat in Insula Cuba" and "é seminibus missis per D. Sessé"; however, the species is not known from Cuba, and presumably was grown from seeds collected in Mexico by Sessé and sent to Havana. From the discussions of McVaugh (2000), it appears that Sessé and Mociño collected the species in Mexico several times, but misdetermined it as *Croton humile* L.; this name was used on the plate Ic. Fl. Mex. 221 and DC. 1120. The specimen at G labelled *C. humile* by Pavón and determined by Müller Argoviensis as *C. ciliatoglanduliferus* is certainly authentic, and is here designated as the neotype. Additional specimens are enumerated by McVaugh (2000).

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA SUR: Rancho San Antonio, E side of Sierra San Francisco, *Moran 23811* (DAV).—SONORA: Mpio. Alamos, 1 mi SW of Alamos, *Sanders 3671* (DAV).—SINALOA: Mpio. San Ignacio, 6 mi NW of Elota, *Webster 19836* (DAV).—NAYARIT: Mpio. Tepic, Volcán Ceboruco, 10–13 km NW of Jala, *Téllez & Miller 10578* (MICH).—JALISCO: Mpio. Autlán de Navarro, 14–15 mi N of Autlán, *Webster & Breckon 15984* (DAV).—MICHOACÁN: Mpio. Jacona, Jacona, *Moore 140* (UC). —GUANAJUATO: Mpio. Silao, Chichiniequillas, *Galván 3386* (MO).

11.2. Croton jucundus Brandegee, Zoe 5: 205. 1905.—TYPE: MEXICO. Sinaloa: Mpio. Culiacán, Yerba Buena, 10 Oct 1904, *Brandegee* (holotype: UC!).

The distinctions between *C. jucundus* and *C. subjucundus* are still poorly understood, because available material for examination is inadequate. As remarked by Croizat, *C. jucundus* appears to have larger flowers and seeds than *C. subjucundus.* It may possibly prove more logical to treat these two taxa as allopatric varieties of a single species. The seed size of the specimens from the Islas Tres Marías agrees better with *C. subjucundus*, so assignment of these collections must be regarded as provisional.

REPRESENTATIVE SPECIMENS. NAYARIT: Islas Tres Marías, María Madre, *Howell 10415* (A, CAS), *10496A* (CAS).

11.3. Croton subjucundus Croizat, Bull. Torrey Bot. Club 69: 451. 1942.—TYPE: MEXICO. Sonora: Navajoa, *Drouet & Richards 3923* (holotype: A!).

As indicated by Steinmann and Felger (1997), this species is known only from three collections from thorn scrub areas in southern Sonora.

REPRESENTATIVE SPECIMEN. SONORA: Mpio. Huatabampo, arroyo 1 mi N of Bachoco, 27 Dec 1986, *Martin & O'Rourke s.n.* (DAV).

11.4. Croton yecorensis V. M. Steinm. & Felger, Novon 8: 207. 1998.—TYPE: MEXICO. Sonora: Mpio. Sahuaripa, 4 km SSW of Mulatos, *Felger & Búrquez 94-574* (holotype: ARIZ; isotype: DAV!).

Although the documented localities of *C. yecorensis* are slightly north of the 28th parallel, it appears quite possible that this species will be encountered to the south. The affinities of *C. yecorensis* are problematic, as remarked by the Steinmann and Felger (1998). Because of various characters, including its bifid rather than quadrifid styles, the species technically does not reside within the boundaries of sect. *Adenophyllum*; however, the glandular-stipitate indumentum and dissected stipules suggest that it fits better here than in any other North American section.

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Sahuaripa, 4 km SSW of Mulatos, *Felger & Búrquez 94-578* (DAV); Mpio. Yécora, Rancho La Pinosa, 10 km W of Río Maicoba bridge on MEX-16, *Felger et al. 94-331* (DAV).

11.5. Croton michaelii V. M. Steinm., Aliso 19: 184. 2001.—TYPE: MEXICO. Durango: Mpio. Durango, Sierra de Cacaria, 5 km W of El Carmen, *Wilson 96-236* (holotype: RSA; isotype: DAV!).

According to Steinmann (2001), this species is very similar to *C. yecorensis* with which it shares the characteristic narrow leaves and bifid styles. If it were not for this similarity, it would be extremely difficult to assign *C. michaelii* to a section, and its placement in sect. *Adenophyllum* must be regarded as provisional.

REPRESENTATIVE SPECIMENS. DURANGO: Mpio. Durango, Sierra de Cacaria, 5 km W of El Carmen, *Wilson 96-235* (RSA).—AGUASCALIENTES: Mpio. Calvillo, 1 km S of presa El Capulín, *Gárcia 2717* (HUAA, fide Steinmann).

12. Croton section **Medea** (Klotzsch) Baillon, Étude Euphorb. 368. 1858.—TYPE: *Medea hirta* Klotzsch [= *Croton timandroides* (Didr.) Müll. Arg.].

Croton disjunctus is referred here with considerable diffidence. The presence of petiolar glands in some populations of this species does not agree with the character of sect. *Medea* as circumscribed by Webster (1993); however, the presence of stipitate glands on leaf margins and bracts does not agree with the characters of sect. *Velamea*, where *C. disjunctus* might also be placed. At present, the sectional assignment of *C. disjunctus* must be regarded as doubtful.

12.1. Croton disjunctus V. M. Steinm., Aliso 19: 185. 2001.—TYPE: MEXICO. Chihuahua: Mpio. Balleza, "24" [2.4?] road miles W of Durango state line on MEX 45, E of canyon of Río Balleza, *Wilson 96-213* (holotype: RSA; isotype: DAV!).

This recently described species is reported by Steinmann (2001) from the type locality and two stations in Aguascalientes, in oak woodland or scrub at 1800–2200 m. Steinmann notes that the population in Chihuahua has basal foliar glands, whereas the plants in Aguascalientes lack them. He suggests a relationship of *C. disjunctus* with *C. fruticulosus* Torr., a species occurring from Texas and Coahuila to eastern Chihuahua; however, *C. disjunctus* shows even closer resemblances to *C. incanus* Kunth, a species occurring from Texas to San Luis Potosí and Querétaro. Except for the rudimentary stipules, the Aguascalientes population of *C. disjunctus* could perhaps be included as a variety of *C. incanus*.

Representative Specimens. Aguascalientes: Mpio. San José de Gracia, Barranca Serpiens, *García 4390* (RSA, not seen); Mpio. Rincón de Romos, mountains above Presa Calles, *Shreve 9263* (DAV).

13. Croton section **Argyroglossum** Baillon, Adansonia I, 4: 289. 1864.—Type: *Croton argyroglossum* Baillon.

This section is represented in western Mexico by a single species.

13.1. Croton culiacanensis Croizat, J. Arnold Arb. 26: 182. 1945.—Type: Mexico. Sinaloa: Culiacán, *Palmer 1507* in 1891 (holotype: A).

So far, all collections of this species have come from Sinaloa. *Croton culiacanensis* is closely related to eastern Mexican *C. watsonii* Standl., which scarcely differs except for its stellate-lepidote (rather than stellate) ovary.

Representative Specimens. Sinaloa: Mpio. Culiacán, Ymala [Imalá], *Palmer 1446* in 1891 (GH); Mpio. Concordia, ca. 9 km NE of Villa Unión, *Sanders et al. 8696* (DAV); Mpio. Mazatlán, low hills 8 mi N of Mazatlán, *Waterfall 12749* (MICH).

14. Croton section **Astraea** (Klotzsch) Baillon, Étude Euphorb. 363. 1858.—Type: *Croton lobatus* L.

The single local (probably introduced) weedy species of this section, *C. lobatus*, differs strikingly from other western Mexican taxa of *Croton* in its deeply 3-lobed leaves, glabrous receptacle of ♂ flowers, and tetragonal seeds.

14.1. Croton lobatus L., Sp. pl. 1005. 1753 ("*C. lobatum*").—Type: [Mexico.] Veracruz, *Houston s.n.* (BM-Clifford Herbarium).

The illustration in Martyn (Hist. Pl. Rar. t. 46. 1737) is probably based on material grown from seed collected by Houston in Veracruz.

Representative Specimens. Sinaloa: Mpio. Culiacán, Culiacán, 20 Aug 1904, *Brandegee* (UC).—Nayarit: Mpio. Compostela, between Villa Varadero and mouth of Río Ameca, *Cházaro & Montes 6333* (MICH).—Jalisco: Mpio. La Huerta, Rancho Cuixmala, *Sanders et al. 8660* (DAV).—Michoacán: Mpio. Tepalcatepec, *Cházaro et al. 5601* (MICH).

15. Croton section **Drepadenium** (Raf.) Müll. Arg., Linnaea 34: 79. 1865.—Type: *Croton punctatus* Lam.

The species of this section are very distinct from other Mexican taxa of *Croton* in the apetalous ♂ flower, and eglandular exstipulate leaves with stellate-lepidote

indumentum. Only one species is recorded for tropical western Mexico, but Steinmann and Felger (1997) list two other species in temperate Sonora: *C. texensis* (Klotzsch) Müll. Arg. and *C. wigginsii* L. C. Wheeler.

15.1. Croton californicus Müll. Arg. in DC., Prodr. 15(2): 691. 1866. *Hendecandra procumbens* Eschsch., Mém. Acad. Imp. Sci. St. Petersbourg Hist. Acad. 10: 287. 1826, non *Croton procumbens* Jacq., 1760.—TYPE: U.S.A. California, 1824, *Eschscholz s.n.* (holotype: not seen, presumably at LE).

This characteristic strand species is common in Alta and Baja California, and extends down the Mexican mainland to Sinaloa. It is very similar to *Croton punctatus* Jacq., widespread on the coasts of the Atlantic and Gulf of Mexico.

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA SUR: Mpio. La Paz, barrier island opposite Puerto López Mateos, *Johnson 1213* (DAV); Peninsula El Mogote, La Paz, *Johnson 1253* (DAV).—SONORA: Mpio. Huatabampito, Playa Huatabampito, *Sanders et al. 4227* (DAV), *Fishbein et al. 1979* (MO). —SINALOA: Mpio. La Cruz de Elota, 7 mi NW of La Cruz, *Johnson 8056* (DAV); Mpio. Culiacán, Altata, *Gentry 5430* (MO).

PHYLLANTHUS

Within FNG, *Phyllanthus* is represented by 21 species in eight sections. Sectional circumscriptions and arrangement follow Webster (1956–58, 1967). Characters used in the key to sections apply only to taxa occurring in Mexico.

KEY TO THE SECTIONS OF PHYLLANTHUS IN WESTERN MEXICO

1. Lateral stem axes not deciduous, not differentiated from main axes; flowers not confined to specialized branchlets; leaves never reduced to scales.
   2. Herbs or undershrubs; leaves mostly not >3 cm long; pollen grains colporate; seeds smooth or verruculose, >3 mm long.
      3. Leaves spiral; fruiting pedicels not bent or reflexed; ♀ flowers with greenish, foliose sepals and the disk dissected; stems ± terete, never winged.
         1. *Phyllanthus* sect. *Paraphyllanthus.*
      3. Leaves distichous; fruiting pedicels ± reflexed; ♀ flowers with often reddish, not foliose sepals and the disk not dissected; stems terete to compressed or winged.
         2. *Phyllanthus* sect. *Loxopodium.*
   2. Shrubs or trees; leaves mostly >3 cm long; pollen grains areolate; seeds smooth, >3 mm long.
      5. *Phyllanthus* sect. *Elutanthos.*
1. Lateral stem axes deciduous; flowers borne only on lateral leafy branchlets; leaves on main axes distally reduced to scales.
   4. Fruits indehiscent; flowers cauliflorous, borne on leafless axes proximal to leafy branchlets; stamens 4, free.
      3. *Phyllanthus* sect. *Cicca.*
   4. Fruits dehiscent; flowers not cauliflorous, borne on leafy branchlets; stamens 2 or 3, free or connate.
      5. Branchlets all or mostly bipinnatiform; disk of ♂ flowers entire or of 3 segments; stamens 3, filaments connate; shrubs or trees.
         4. *Phyllanthus* sect. *Nothoclema.*
      5. Branchlets pinnatiform; disk of ♂ flowers entire or of 5 or 6 segments; stamens 2 or 3, filaments free to connate; shrubs or herbs.
         6. Shrubs; branchlets fascicled, with only 5–10 leaves; leaf blades hirtellous abaxially on midrib; disk of ♂ flowers annular; stamens 3, free, filaments shorter than anthers.
            6. *Phyllanthus* sect. *Brachycladus.*
         6. Herbs; branchlets not regularly fascicled, with 10 or more leaves; leaf blades glabrous; disk of ♂ flowers dissected; stamens 2–5, free or connate, filaments usually longer than anthers.

7. Stamens 5, filaments free; fruiting pedicels capillary, 3–8 mm long; ♀ flowers often 2 per node; seeds papillose. 7. *Phyllanthus* sect. *Pentandra.*
7. Stamens 2 or 3, filaments free or connate; fruiting pedicels 1–5 mm long; ♀ flowers solitary; seeds striate, ribbed, or puncticulate. 8. *Phyllanthus* sect. *Phyllanthus.*

1. Phyllanthus section **Paraphyllanthus** Müll. Arg., Linnaea 32: 3. 1863; DC. Prodr. 15(2): 355. 1866.—LECTOTYPE, designated by Webster, 1956: *Phyllanthus maderaspatensis* L.

There are about ten species of this section in Mexico, of which three are common in Nueva Galicia. A fourth, *P. polygonoides* Nutt. ex Spreng., reaches only Aguascalientes. There has been much confusion about species circumscriptions, and a high percentage of Mexican specimens (other than *P. polygonoides*) have been misidentified.

KEY TO THE SPECIES OF PHYLLANTHUS SECTION PARAPHYLLANTHUS IN WESTERN MEXICO

1. Styles distinctly bifid, 0.3–1.3 mm long; staminal column 0.5–1.5 mm long.
   2. Leaves broadly elliptic to suborbicular; styles at least 1 mm long; stipules less than 1 mm long. 1.1. *P. gypsicola.*
   2. Leaves obovate; styles less than 1 mm long; stipules usually at least 1 mm long.
      3. Herb not over 0.5 m tall, stems clustered at base; stipules distinctly auriculate at base; seeds not over 1.5 mm long. 1.3. *P. polygonoides.*
      3. Shrubs to 1–2 m tall; stipules not distinctly auriculate at base; seeds 1.7–2.4 mm long.
         4. Branches smooth; seeds 1.9–2.4 mm long. 1.2a. *P. peninsularis* subsp. *peninsularis.*
         4. Branches papillate; seeds 1.7–2 mm long. 1.2b. *P. peninsularis* subsp. *novogalicianus.*
1. Styles undivided, 1–1.5 mm long; staminal column 1.5–2 mm long. 1.4. *P. galeottianus.*

1.1. Phyllanthus gypsicola McVaugh, Brittonia 13: 194. 1961.—TYPE: MEXICO. Colima: 11 mi SSW of Colima, in deciduous woodland with *Bursera*, *Amphipterygium*, 400–500 m, *McVaugh & Koelz 1573* (holotype: MICH!; isotype: DAV!).

Although most collected in Colima, this species also occurs in southern Baja California, where it has been confused (as noted below) with *P. peninsularis*. However, in leaf shape and dimensions of flowers, it is more similar to *P. galeottianus* and appears to be a lower-elevation, more xeric vicariant of that species.

REPRESENTATIVE SPECIMENS. BAJA CALIFORNIA SUR: Mpio. La Paz, 14 mi by road E of Cabo San Lucas, 30 m, *Hastings & Turner 64-345* (DS); Cabo San Lucas, *Brandegee 540* (UC).—JALISCO: Mpio. La Huerta, Cerro Maderas, 200 m, *Lott 1823* (TEX).—COLIMA: Mpio. Comala, 19–20 km NW of Colima, 1400 m, *Santana et al. 5269* (WIS); Mpio. Colima: 15 mi SSW of Colima, *McVaugh 15542* (DAV, MICH).

1.2. Phyllanthus peninsularis Brandegee, Erythea 7: 8. 1899.—TYPE: MEXICO. Baja California Sur: San José del Cabo, *Anthony 364* (lectotype, here designated: UC!; isolectotype: MO!).

Brandegee cited both San José del Cabo and Sierra la Laguna, and indicated his number 539. Unfortunately, *Brandegee 539* could not be located; there is a Brandegee collection labelled number 15 from Sierra La Laguna that does represent

P. peninsularis. Another collection at Berkeley (UC) is *Brandegee 540*, which represents the Baja California form of *P. gypsicola* McVaugh. In order to preserve the name *Phyllanthus peninsularis* in the sense it has been used by most botanists, it is preferable to select as lectotype *Anthony 364*, also from San José del Cabo, and the only other collection number cited in the protologue.

A number of collections of *P. peninsularis* from the mainland (Nayarit and Jalisco) and some from Baja California have been mistakenly identified as *P. galeottianus* or *P. subcuneatus* Greenm. All of the Nueva Galician specimens differ from *P. galeottianus* in having narrower leaf blades, distinctly bifid styles, and smaller ♂ flowers (sepals less than 2 mm long, staminal column <1.5 mm long). Also, they differ in their larger, more pointed leaf blades and bifid styles from *P. subcuneatus*, which seems to be confined to the Sierra Madre Oriental.

Phyllanthus peninsularis displays a gap in geographic variation between the populations in Baja California and on the mainland. It is therefore necessary to recognize two subspecies, one of which is here described.

1.2a. Phyllanthus peninsularis subsp. **peninsularis.**

Twigs smooth; sepals of ♂ flowers (1.5–) 1.8–2.5 mm long; seeds 2.1–2.4 mm long.

Representative Specimens. Baja California Sur: Mpio. La Paz, Isla Espiritu Santo, *Wiggins 16121* (MICH); Sierra La Laguna, *Brandegee 15* (UC), *Moran 7430* (DS, US); La Burrera, 27 km E of Todos Santos, *Tenorio et al. 10516* (MEXU); Saucito, 1891, *Brandegee s.n.* (UC, US); San José del Cabo, *Brandegee 540* (UC), *Dawson 1178* (MICH).

1.2b. Phyllanthus peninsularis subsp. **novogalicianus** G. L. Webster, subsp. nov.—Type: Mexico. Jalisco: Mpio. Talpa de Allende, 11–12 mi S of Talpa, 1200–1700 m, in subtropical mixed forest with *Carpinus, Magnolia, Quercus,* and *Matudaea*, *McVaugh 20390* (holotype: MICH!). Fig. 2.

Phyllanthus peninsularis subsp. novogalicianus ab subsp. peninsulari differt ramulis papillosis, floribus ♂ minoribus, seminibus 1.7–2 mm longis.

It must be noted that specimens from Sinaloa (*H. S. Gentry 11446, 24330*, MICH) and Nayarit (*Palmer 1887*, MICH) are atypical in lacking the papillate branches and appear transitional to *P. gypsicola*.

Representative Specimens. Nayarit: Tepic, *Palmer 1887* (US); Mpio. Tepic: 13 km by road W of junction of MEX-15 and Nay-66, 1225 m, *Steinmann & Varela 1076* (DAV).—Jalisco: Mpio. Cuautitlán, Sierra de Manantlán, 30–35 km SE of Autlán, *McVaugh 23228* (MICH); 1–2.5 km SW of Rincón de Manantlán, *Judziewicz & Guzmán 5062* (MICH).

1.3. Phyllanthus polygonoides Nutt. ex Spreng., Syst. veg. 3: 23. 1826. *Maschalanthus polygonoides* (Nutt. ex Spreng.) Nutt., Trans. Amer. Philos. Soc., ser. 2, 5: 175. 1837.—Type: U.S.A. "Arkansas," *Nuttall s.n.* (lectotype, here designated: NY!).

This species, primarily of the Chihuahua Desert and Texas, barely enters tropical western Mexico in Aguascalientes and southern Sonora; collections from Municipios Bacerac and Cucurpe, Sonora, are cited by Steinmann and Felger (1997).

Representative Specimens. Sonora: Mpio. Alamos, Cañón Saucito, *Gentry 689* (F).—Aguascalientes : 6 km E of Tepezalá, *Rzedowski & McVaugh 1230* (MICH).

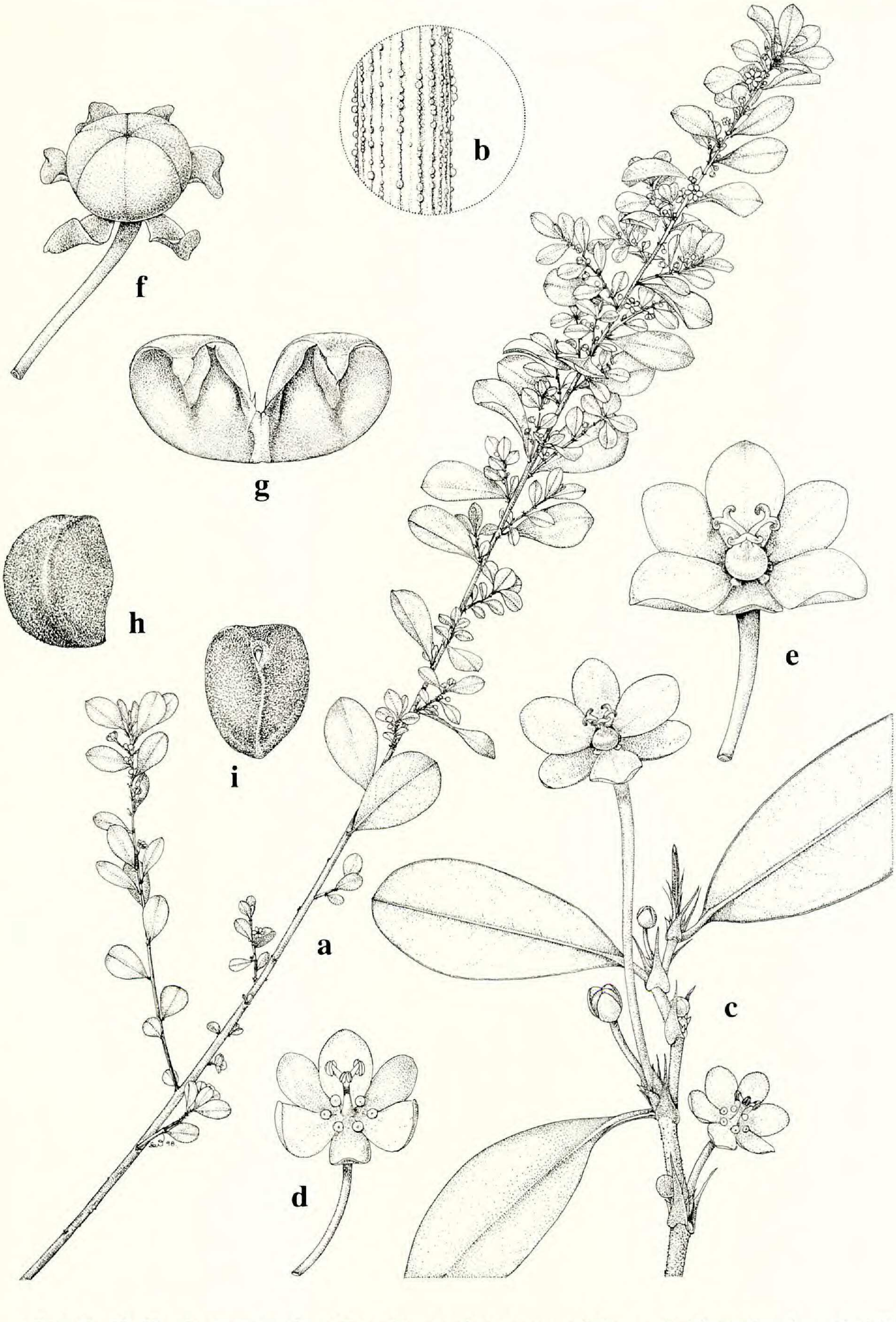

FIG. 2. *Phyllanthus peninsularis* Brandegee subsp. *novogalicianus*. A. Flowering branch, ×0.75. B. Stem with papillae, ×10. C. Tip of branch with pistillate flower above and staminate flower below, ×3.5. D. Staminate flower, ×7.5. E. Pistillate flower, ×7.5. F. Capsule, ×6. G. Two cocci of dehisced capsule, ×9. H. Seed, lateral view, ×10. I. Seed, adaxial view, ×10.

1.4. Phyllanthus galeottianus Baill., Adansonia I, 1: 32. 1860.—TYPE: MEXICO. Michoacán: Morelia, *Galeotti 7215* (lectotype, here designated: P!).

Phyllanthus americanus Sessé & Moc., Pl. nov. hisp. 159. 1890.—TYPE: MEXICO. Guerrero: Mazatlán, *Sessé & Moçiño s.n.* (lectotype, here designated:G-Del; isotype: MA!). [The MA sheet is numbered 4561; a painting (Ic. Fl. Mex. 298) is at G.]

As pointed out before (Webster 1966), Baillon cited the specimen at G-Delessert at a time before the "Icones Flora Mexicanae" were rediscovered. McVaugh (2000) enumerates in detail the specimens and drawings associated with the names *Phyllanthus americanus* and *P. galeottianus*, but does not typify either name.

The name *P. galeottianus* has been mistakenly applied to the majority of specimens of sect. *Paraphyllanthus* in Mexico. In the strict sense, the species includes only upland plants (1000 m elevation) in the central and western Mexican highlands (Guanajuato and Jalisco to Guerrero and México) with larger flowers and unlobed styles. For clarification, additional specimens are cited from states in eastern Mexico.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. Guadalajara: barrancas, *Pringle 4443* (MICH, MO); Mpio. Tuxcacuesco, 5–6 km ENE of Zenzontla, 1100 m, *Santana & Benz 5922* (WIS).—MÉXICO: Temascaltepec, *Hinton 4497* (LL).—GUERRERO: Mpio. Coyuca, Mina, Carrizeras, *Hinton 10482* (MICH).—OAXACA: Mpio. San Juan Mixtepec, Río San Lucas, 1780 m, *Reyes Santiago 389* (MEXU).—CHIAPAS: Mpio. Jitotol, 1450 m, *Breedlove 26400* (CAS).

2. Phyllanthus section **Loxopodium** G. L. Webster, Contr. Gray Herb. 176: 46. 1955.—TYPE: *Phyllanthus caroliniensis* Walt.

The widespread American species *P. caroliniensis* has not been recorded from western Mexico; we have only the following two species in this section.

2.1. Phyllanthus evanescens Brandegee, Zoe 5: 207. 1905.—TYPE: MEXICO. Sinaloa: Culiacán, *Brandegee s.n.* (holotype: UC!).

Phyllanthus pudens L. C. Wheeler, Contr. Gray Herb. 127: 50. 1939. *Phyllanthus avicularia* Small, Bull. Torrey Bot. Club 27: 278. 1900, non *Phyllanthus avicularis* Müll. Arg., 1863.—TYPE: U.S.A. Texas: Austin Co., "Columbia" [Columbus], *B. F. Bush 263* (holotype: NY).

Stems scabridulous or hispidulous; filaments free; fruiting pedicel 1.2–1.8 (–2.2) mm long; styles bifid, not dilated; capsule 2.8–3.2 mm in diameter, seeds 1.3–1.6 mm long.

The characters used by Texas authors to recognize populations from Tamaulipas and southern Texas as *P. pudens* appear indistinguishable from those used to delimit populations from western Mexico as *P. evanescens*. *Phyllanthus evanescens*, a species characteristic of seasonally inundated grassy habitats, is disjunct to Nicaragua, and may be expected elsewhere in northern Central America.

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Culiacán, Lodiego, 55 km NE of Culiacán, *Palmer 1590* (US).—JALISCO: Mpio. Jocotepec, Ejido Zapotitán de Hidalgo, *Machuca 3417* (WIS); Mpio. La Huerta, Est. Biol. Chamela, *Lott & Ayala 2629*, *McVaugh 25197* (MICH). —GUANAJUATO: Mpio. Jaral del Progreso, Santiago Capitiro, *Rzedowski 39366* (DAV). Also reported from Sonora by Steinmann and Felger (1997: 62).

2.2. Phyllanthus brandegei Millsp., Proc. California Acad. Sci., ser. 2, 2: 218. 1889.—TYPE: MEXICO. Baja California Sur: Comondú, 17 Feb 1889, *T. S. Brandegee 19* (holotype: UC!).

Stems smooth; filaments connate; fruiting pedicel 1.8–1.9 mm long; styles dilated; capsule 3.5–4 mm in diameter, seeds 1.8–1.9 mm long.

Phyllanthus brandegei is known only from the type collection and possibly is extinct. A specimen from Sonora (Mpio. Huatabampo, 2 km NE of Las Aguilas, *Sanders et al. 13562*, UCR) appears somewhat intermediate between *P. evanescens* and *P. brandegei*; it has the smooth stems, dilated styles, and larger seeds of the latter, but free filaments and shorter fruiting pedicels of the former.

3. Phyllanthus section **Cicca** (L.) Müll. Arg., Linnaea 32: 50. 1863. *Cicca* L., Mant. pl. 124. 1767.—TYPE: *Cicca acida* L. [=*Phyllanthus acidus* (L.) Skeels].

Since my original consideration of subg. *Cicca* (Webster 1957), the status of sect. *Aporosella*, to which our only local species belongs, has been reevaluated. In 1957, sect. *Aporosella* was maintained as distinct from sect. *Cicca* because of its dioeciousness and lack of a floral disk. Yet, vegetatively the two groups are similar, and both have drupaceous fruits produced ramiflorously. It seems appropriate to recognize this similarity by delimiting sect. *Cicca* as comprising two subsections, the monotypic subsect. *Cicca* and subsect. *Aporosella*.

Phyllanthus subsection **Aporosella** (Chodat) G. L. Webster, stat. nov. *Aporosella* Chodat, Bull. Herb. Boiss., sér. 2, 5: 488. 1905. *Phyllanthus* sect. *Aporosella* (Chodat) G. L. Webster, J. Arnold Arb. 38: 72. 1957.—TYPE: *Aporosella hassleriana* Chodat [=*Phyllanthus chacoensis* Morong].

The subsection includes only two species, the South American *P. chacoensis* and our local species, *P. elsiae*.

3.1. Phyllanthus elsiae Urb., Repert. Spec. Nov. Regni Veg. 15: 405. 1919.—TYPE: TRINIDAD AND TOBAGO. Tobago: Auchenskeoch Beach, *Broadway 4789* (lectotype, designated by Webster, 1957: US!).

In an earlier review (J. Arnold Arb. 38: 75. 1957), *P. elsiae* was reported from western Mexico only from Nayarit. Since then, it has been found at a number of different localities, most often in coastal woods adjacent to mangroves. It is closely related to *P. chacoensis* Morong of the Pantanal region of South America.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Tuxpan, Mexcaltitán, *Mexia 1005* (US).—JALISCO: Mpio. La Huerta, Cuixmala, *Castillo 5149, 5235* (DAV), *Lott et al. 3472* (MO).—COLIMA: Mpio. Manzanillo, Laguna Cuyutlán, *McVaugh 15628* (MICH).—MICHOACÁN: Mpio. Coahuayana, mouth of Río Coahuayana, *Turner 1999* (TEX).

4. Phyllanthus section **Nothoclema** G. L. Webster, Contr. Gray Herb. 176: 56. 1955.—TYPE: *Phyllanthus acuminatus* Vahl.

Only three species of this American section of ten species, characterized by its mostly bipinnatiform branchlets, have been recorded from western Mexico.

Key to the Species of Phyllanthus Section Nothoclema in Western Mexico

1. Leaf blades scabrous adaxially, acute or acuminate; anthers acute; styles ± dilated; branchlets mostly with 10–20 lateral axes. 4.1. *P. acuminatus.*
1. Leaf blades smooth adaxially, acute to rounded; anthers emarginate or obtuse; styles slender; branchlets with 0–15 lateral axes.
   2. Branchlets with 10–15 lateral axes; pedicels of ♂ flowers not over 5 mm long; sepals 1 mm long. 4.2. *P. micrandrus.*
   2. Branchlets with 1–4 (–8) lateral axes (sometimes simple); pedicels of ♂ flowers 5–15 mm long; sepals 1.5 mm long or more. 4.3. *P. mocinianus.*

4.1. Phyllanthus acuminatus Vahl, Symb. bot. 2: 95. 1791.—Type: Trinidad. *Ryan s.n.* (holotype: C!).

?*Phyllanthus sessei* Briquet, Ann. Conserv. Jard. Bot. Genève 4: 224. 1900.—Type: Mexico. *Sessé & Mociño* (G-Del, holotype).

This widespread species extends from Mexico to Argentina and Brazil, but is very uncommon in western Mexico, where it occurs in disturbed woodlands below 1000 m. Synonymy and a map of the Caribbean distribution have been given earlier (J. Arnold Arb. 38: 365–367. 1957).

The citation of *Phyllanthus sessei* Briq. as a synonym of *P. acuminatus* is made with some doubt, because of floral differences pointed out by Webster (1966) (especially Briquet's description of the calyx of the male flowers as ca. 1.5 mm long in *P. sessei*). McVaugh (2000) cites other specimens and drawings from the Sessé and Mociño collections, and also suggests that *P. sessei* is probably a synonym of *P. acuminatus*. Re-examination of this material is desirable to determine if Briquet's description is erroneous, or if *P. sessei* is yet another endemic species in Nueva Galicia.

Representative Specimens. Baja California Sur: Mpio. La Paz, La Burrera, 27 km E of Todos Santos, *Tenorio et al. 10506* (DAV).—Nayarit: Mpio. Tuxpan, camino a est. microondas Peñitas, *Téllez 12805* (MICH); Mpio. Compostela, 7–9 km W of Mazatlán, *Téllez & Davila 9070* (MEXU).—Jalisco: Mpio. La Huerta, 15 km NW of Juan Gil Preciado, *Santana & Cervantes 499* (WIS).—Colima: Mpio. Manzanillo, 13 mi N of Santiago, *McVaugh 15839* (MICH, US).—Michoacán: Mpio. Aquila, Aquila, *Hinton 15065, 16109* (MICH, US).

4.2. Phyllanthus micrandrus Müll. Arg., Linnaea 32: 27. 1863; DC., Prodr. 15(2): 383. 1866.—Type: Venezuela. Aragua: Colonia Tovar, *Fendler 1195* (lectotype, here designated: G!; isolectotypes: K! MICH! MO!).

Phyllanthus micrandrus occurs in deciduous and oak woodlands mainly from 1000–1500 m. It is similar to *P. mocinianus* in aspect and sometimes mistaken for it; however, it is readily separable by its more highly ramified branchlets and much smaller flowers. The disjunction in the range of the Mexican populations of *P. micrandrus* from those in Costa Rica and South America is remarkable, but is paralleled by the distribution of *P. botryanthus* of sect. *Elutanthos*. It is possible that further study of the Mexican plants may show them to be a distinct subspecies, but the few specimens available do not show any clear morphological differences.

Representative Specimens. Nayarit: Islas Tres Marías, María Madre, *Howell 10452* (A, CAS); Mpio. Compostela, 4 mi N of San Juan Caxstle, *Norris & Taranto 13668* (MICH).—Jalisco: Mpio. Guadalajara, Barranca de Huentitán el Alto, *Cházaro et al. 6260* (MO), *Flores Macias & Reynoso 1106* (WIS); Mpio. Autlán de Navarro, 9–10 mi SW of Autlán, *McVaugh 14201* (MICH).

4.3. Phyllanthus mocinianus Baillon, Adansonia I, 1: 35. 1860.—TYPE: MEXICO. *Sessé & Mociño s.n.* (lectotype, designated by McVaugh, 2000: G-Del!).

This is by far the commonest representative of sect. *Nothoclema* in both western and eastern Mexico and extends to Belize and Guatemala. In Nueva Galicia, it is found in a variety of habitats, from lowland deciduous woodlands or scrub to mesic woodlands in upland (to 1100 m) barrancas. It is morphologically similar to *P. anisolobus* Müll. Arg. of Costa Rica to Ecuador, and was circumscribed to include that species by Burger and Huft (1995). However, *P. mocinianus* may be separated by its androecium with shorter staminal column and horizontally dehiscent (not deflexed) anthers, as well as by its shorter styles.

REPRESENTATIVE SPECIMENS. CHIHUAHUA: Batopilas, *Gentry 2619* (A, MO).—SINALOA: Sierra Surotato, Quebrada de Mansana, *Gentry 6534* (GH, MO).—NAYARIT: Islas Tres Marías, María Madre, *Ferris 5569* (A, DS); Mpio. Ruiz, 2–3 km E of El Venado, *Breedlove & Almeda 45209* (CAS).—JALISCO: Mpio. La Huerta, Rancho Cuixmala, *Lott & Philips 3671* (DAV).—COLIMA: Cd. Colima, *Jones 23* (DS).—MICHOACÁN: Mpio. Coalcomán de Matamoros, Coalcomán, *Hinton 13882* (GH, TEX).—MÉXICO: Temascaltepec, Mpio. Tejupilco, Nanchititla, *Hinton 5330* (GH, MO, TEX).

5. Phyllanthus section **Elutanthos** Croizat, J. Wash. Acad. Sci. 33: 12. 1943.—TYPE: *Phyllanthus glaucescens* Kunth [=*P. grandifolius* L.].

This neotropical section includes three species in western Mexico and several others in eastern Mexico, including the type species, *P. grandifolius* L.

KEY TO THE SPECIES OF PHYLLANTHUS SECTION ELUTANTHOS IN WESTERN MEXICO

1. Stamens 3, anthers borne on filaments; seeds 2–8 mm long.
   2. Styles distinctly bifid; sepals >2 mm long; stamens free or nearly so; seeds ca. 8 mm long. 5.1. *P. coalcomanensis.*
   2. Styles entire or emarginate; sepals <2 mm long; stamens connate, forming a column; seeds 2–2.5 mm long. 5.2. *P. botryanthus.*
1. Stamens 2, anthers sessile (the two modified and seemingly a single anther); seeds 6.5–8 mm long. 5.3. *P. tequilensis.*

5.1. Phyllanthus coalcomanensis Croizat, J. Wash. Acad. Sci. 33: 13. 1945.—TYPE: MEXICO. Michoacán: Coalcomán, *Hinton 15857* (holotype: US!; isotype: MICH!).

Phyllanthus coalcomanensis grows in perhaps somewhat less xeric lowland (up to 500 m) forests than *P. botryanthus*. It appears to be rather uncommon, with a few collections known from Nayarit, Colima, and Michoacán, but so far none from Jalisco. It is possible that this species occurs further east to Chiapas and even Nicaragua, but the available collections are so incomplete that they can be only tentatively assigned to *P. coalcomanensis*.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Tuxpan Peñitas, estación microondas Peñitas, *Téllez 12674* (MO); Mpio. San Blas, Ensenada de Matanchén, *Ferris 5437* (DS, US).—COLIMA: Mpio. Manzanillo, 8 mi WNW of Santiago, *McVaugh 15785* (MICH, US).—MICHOACÁN: Mpio. Aquila, wooded hill and barranca, *Hinton 15859, 15967* (MICH, US).

5.2. Phyllanthus botryanthus Müll. Arg. in DC., Prodr. 15(2): 323. 1866.—TYPE: COLOMBIA. Bolívar: Cartagena, *Triana 3664* (lectotype, designated by Webster, 1958: P!; isotypes: K! W!).

This species, which is common in lowland tropical woodlands in Jalisco (but not elsewhere in Nueva Galicia), has not been previously reported from North America. The Mexican populations are disjunct from xeric areas in coastal northern South America (Colombia to Venezuela and the Dutch offshore islands, Aruba to Bonaire); no intermediate populations are known in Central America. This appears to be an unusual geographic pattern in *Phyllanthus*, although it may represent an extreme of a pattern shown by other members of the Euphorbiaceae (e.g., *Croton morifolius*), which extend from Mexico into Nicaragua, with a gap only in Costa Rica and Panama.

Representative Specimens. Jalisco: Mpio. Tomatlán, 46 km N of Chamela, *Guadalupe Ayala 160* (MICH); Mpio. La Huerta, 2.5 km W of Quémaro, *Lott 1716* (MICH); Rancho Cuixmala, *Castillo et al. 52320* (MO), *Lott et al. 3705* (MO).

5.3. Phyllanthus tequilensis B. L. Rob. & Greenm., Proc. Amer. Acad. Arts 29: 392. 1894.—Type: Mexico. Jalisco: Tequila, *Pringle 5490* (holotype: GH!; isotypes: MO! UC!).

Phyllanthus micromalus McVaugh, Brittonia 13: 198. 1961.—Type: Mexico. Nayarit: 10 mi SE of Tepic, *McVaugh 16569* (holotype: MICH!; isotype: DAV!).

This species is common especially in dry woodlands (oak and tropical deciduous) from 300–1500 m in Jalisco, Nayarit, and the Tres Marías Islands, where it has often been misidentified as *P. adenodiscus* Müll. Arg. or *P. grandifolius* L. It is readily distinguished by its inflated capsules, 3–4 cm broad, and by its unique androecium of two stamens modified so that there appears to be a single anther dehiscing upwardly. East of the Nueva Galicia region, specimens have been seen that may also referable to *P. tequilensis*, but with smaller fruits and seeds (e.g., *Ramírez Cantú s.n.* from Isla Roqueta, Acapulco, Gro., MEXU). A single collection from Chamela, Jalisco (*Lott et al. 1564*, MICH), where the species is not common, has capsules only 1.5 cm in diameter, and thus resembles the Guerrero collection. These small-fruited plants appear to represent *P. oaxacanus* Brandegee, described from "San Geronimo" [San Jerónimo], Oaxaca (*Purpus 7154*, UC, holotype!; MO, isotype). Flowering specimens from southern Oaxaca, 75 miles by road SE of Oaxaca (*Croat 39957, 39958*, MO) have flowers typical for *P. tequilensis*. It is conceivable that *P. oaxacanus* could be retained as a small-fruited subspecies of *P. tequilensis*, of which the Chamela collection is the northernmost locality; however, sampling of fruiting specimens of Mexican collections of sect. *Elutanthos* is so inadequate that the problem cannot be resolved at this time.

Representative Specimens. Sinaloa: Mpio. Culiacán, Baila, Santa María, *González Ortega 6708* (CAS).—Durango: Mpio. Mezquital, Huasemote, *Rose 2315* (US).—Zacatecas: Mpio. Juchipila, 5 km SE of Pueblo Nuevo, *Rzedowski 18264* (MICH).—Nayarit: Islas Tres Marías, María Madre, *Ferris 5697* (DS, US); Mpio. Compostela, 5 mi NW of Las Piedras, *Webster & Lynch 17124* (DAV).—Jalisco: Mpio. Juchitlán, Los Carrales a Los Guajes, *Machuca & Cházaro 6579* (DAV, MO).—Michoacán: Mpio. Jungapeo, abajo de Agua Blanca, *Martínez 376* (DAV).

6. Phyllanthus section **Brachycladus** G. L. Webster, sect. nov.—Type: *Phyllanthus rupestris* Kunth in H. B. K.

Frutices monoici; ramulis deciduis, floriferis, fasciculatis, non ramosis, foliis paucis (5–10); sepalis ♂ 6; discus integer; stamina 3, filamentis liberis connatisve; antherae muticae; pollinis grana globosa areolata; sepalis ♀ 6; discus patelliformis; ovarium triloculare; stylis liberis, bifidis; fructus capsularis; semina laevia.

Monoecious shrubs with phyllanthoid branching; branchlets fasciculate, unramified, with few leaves (5–10); ♂ flowers with 6 sepals, an annular disk, and 3 stamens with the filaments free or connate and the anthers muticous, the pollen grains globose, areolate, areoles polybrochate; ♀ flowers with 6 sepals, a patelliform disk, a 3-locular ovary, and free and bifid styles with slender branches; fruit capsular, seeds smooth.

Section *Brachycladus* is primarily a South American group, with most species confined to the Amazon Basin. At least six South American species can be referred here, including *P. adianthoides* Klotzsch, *P. atabapoensis* Jabl., *P. paezensis* Jabl., *P. rupestris* Kunth, and two undescribed species. All of the species seem to be characteristic of riparian habitats in areas of tropical evergreen forest. The affinities of sect. *Brachycladus* are clearly with taxa of subg. *Xylophylla*, as shown by the characteristic areolate pollen grains, but the section appears to be isolated by its androecium of discrete stamens, annular disk in the ♂ flowers, and short branchlets with few leaves.

6.1. Phyllanthus mickelii McVaugh, Brittonia 13: 196. 1961.—TYPE: MEXICO. Colima: Mpio. Manzanillo, 8 mi WNW of Santiago, *McVaugh 15763* (holotype: MICH!).

Phyllanthus mickelii, the only representative of sect. *Brachycladus* in North America, is highly disjunct from the other species; also, it is ecologically divergent in its deciduous woodland habitat (especially in woods of *Piranhea*). It would appear to be most closely related to *P. rupestris*, which is widespread from Amazonian Colombia to Brazil. The resemblance between the two species is very close, although the leaves of *P. rupestris* differ in their more prominulous venation. Because of the scarce material of *P. mickelii* available for study, a final decision on its status as a distinct species cannot yet be made.

ADDITIONAL SPECIMENS EXAMINED. JALISCO: Mpio. La Huerta, Estación Biológica Chamela, *Lott 2592* (MICH), *3820* (MO), *3897*(DAV), *Pérez 1760* (DAV, MEXU).

7. Phyllanthus section **Pentandra** G. L. Webster, J. Arnold Arb. 48: 333. 1967.—TYPE: *Phyllanthus pentandrus* Schumach. & Thonn.

This African-Malagasian section of shrubs and herbs is represented in the New World only by the following introduced herbaceous species.

7.1. Phyllanthus tenellus Roxb., Flora Indica, ed. 2, 3: 668. 1832.—TYPE: INDIA. West Bengal: Calcutta Botanical Gardens, *Wallich 7892 ex p.* (holotype: K!).

The single collection cited below represents a new record for Mexico; the species has previously been recorded from the New World only in the eastern U.S.A., the West Indies, and South America.

SPECIMEN EXAMINED. NAYARIT: Mpio. Tepic, ca. 15 km W of Tepic, *Steinmann & Varela 1079* (DAV).

8. **Phyllanthus** section **Phyllanthus.**

Five species of sect. *Phyllanthus*, all herbaceous, have been recorded from western Mexico.

KEY TO THE SPECIES OF PHYLLANTHUS SECTION PHYLLANTHUS IN WESTERN MEXICO

1. Cymules unisexual, ♂ flowers at proximal nodes of branchlet.
   2. Leaf blades distinctly inequilateral at base; seeds verruculose, 1.5–1.8 mm long. 8.1. *P. niruri.*
   2. Leaf blades not distinctly inequilateral at base; seeds striate or finely ribbed, <1.5 mm long.
      3. Stamens 3; sepals of ♂ flowers 5 or 6.
         4. Stems often with aerenchyma at base; leaf blade margins often reddish; disk of ♀ flowers 5-angled; filaments completely connate. 8.2. *P. stipulatus.*
         4. Stems without aerenchyma, leaf blade margins never reddish; disk of ♀ flowers asymmetrically 3-lobed; filaments connate in proximal half. 8.3. *P. caribaeus.*
      3. Stamens 2; sepals of ♂ flowers 4. 8.4. *P. standleyi.*
1. Cymules bisexual (at least at distal nodes of branchlet).
   5. Sepals 5, distinctly acute; disk of ♀ flowers 5-lobed; distal cymules each with 1 ♂ and 1 ♀ flower; seeds finely ribbed on back, 0.9–1 mm long; leaf blades oblong. 8.5. *P. amarus.*
   5. Sepals 6, obtuse or subacute; disk of ♀ flowers 6-lobed; distal cymules each with 1 ♀ and 1–3 ♂ flowers; seeds striate on back, 1.2–1.5 mm long; leaf blades elliptic. 8.6. *P. hexadactylus.*

8.1. Phyllanthus niruri L., Sp. pl. 981. 1753.—TYPE: specimen in the Hortus Cliffortianus Herbarium (holotype: BM!).

This widespread American species, characteristically occurring in upland montane evergreen forests (>1000 m), has also been found near sea level in deciduous forest and woodlands in Sinaloa. It has been confused with several neotropical and paleotropical species, but has not been introduced into the Old World. It is rather variable, and a number of segregates have been proposed (Webster 1970).

REPRESENTATIVE SPECIMENS. SINALOA: Mpio. Culiacán, road to Presa Adolfo López Mateos, *Steinmann & Varela 1155* (DAV); Mpio. Mazatlán, 7 mi SE of Mazatlán, *Webster & Breckon 15636* (DAV).—NAYARIT: Mpio. Tepic, mountains 9.5 mi W of Tepic, *McVaugh 18945* (MICH).—JALISCO: Mpio. Talpa de Allende, 11–12 mi S of Talpa, *McVaugh 20407* (MICH).

8.2. Phyllanthus stipulatus (Raf.) Webster, Contr. Gray Herb. 176: 53. 1955. *Moeroris stipulata* Raf., Sylva tellur. 91. 1838.—TYPE: JAMAICA. *Swartz s.n.* (lectotype, designated by Webster, 1955: S!).

This widespread species of semi-aquatic or aquatic habitats is recorded in western Mexico only from the following collection.

SPECIMEN EXAMINED. NAYARIT: Mpio. Compostela, wet meadow 4–5 mi N of Compostela, *McVaugh 19328* (MICH).

8.3. Phyllanthus caribaeus Urb., Symb. antill. 5: 382. 1908.—TYPE: TRINIDAD AND TOBAGO. Tobago: *Eggers 5733* (lectotype, designated by Webster, 1957: F!; isotype: NY!).

This Doppelgänger of *P. stipulatus* apparently replaces that species in western Mexico. Only one character, the unusual asymmetrical disk in the ♀ flower, is invariably diagnostic for distinguishing *P. caribaeus*. It seems to be ecologically separated from *P. stipulatus* by occurring in moist forest rather than in aquatic habitats.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Tepic, 9.5 mi W of Tepic, *McVaugh 18945* (MICH).—JALISCO: Mpio. Tecalitlán, between Tecalitlán and San Isidro, *McVaugh 16176* (DAV, MICH).

8.4. Phyllanthus standleyi McVaugh, Brittonia 13: 199. 1961. *Phyllanthus perpusillus* Standl., Amer. Midl. Nat. 36: 178. 1948, non *Phyllanthus perpusillus* Baillon, 1866.—TYPE: MEXICO. Michoacán: 2 mi W of Uruapan, *Leavenworth & Hoogstraal 1282* (holotype: F).

This diminutive species, found in pine or oak forests or deciduous woodlands (300–1200 m), in most instances is readily distinguishable from *P. caribaeus* and *P. stipulatus* by its ♂ flowers with a 4-merous perianth and an androecium of two stamens.

REPRESENTATIVE SPECIMENS. NAYARIT: Mpio. Santa María del Oro, oak woods 25 km by road SE of Tepic, *Webster & Breckon 15683* (DAV).—JALISCO: Mpio. La Huerta, Rancho Cuixmala, *Lott et al. 2891* (DAV, MICH).—COLIMA: Mpio. Colima, 11–12 mi SSW of Colima, *McVaugh 16038* (MICH), *Webster & Breckon 16129* (DAV).

8.5. Phyllanthus amarus Schumach. & Thonn., Beskr. guin. pl. 421. 1827.—TYPE: GHANA. "Guinea," *Schumacher & Thonning* (holotype: C!).

Undoubtedly the commonest, weediest, and most widespread of all species of *Phyllanthus*, *P. amarus* has a pantropical distribution. Although there are few collections from Nueva Galicia, this weedy species will surely be encountered in other lowland areas.

REPRESENTATIVE SPECIMENS. JALISCO: Mpio. La Huerta, Rancho Cuixmala, *Lott et al. 3565* (DAV); Mpio. Cihuatlán, 9 mi N of W end of Bahía Navidad, *McVaugh 20917* (MICH).—COLIMA: Colima, *Orcutt 6925* (DS); Manzanillo, *Palmer 925* in 1890 (US).

8.6. Phyllanthus hexadactylus McVaugh, Brittonia 13: 195. 1961.—TYPE: MEXICO. Michoacán: Mpio. Apatzingán, 4 mi W of Apatzingán, *McVaugh 17945* (holotype: MICH!; isotype: DAV!).

This diminutive species has a curious disjunct distribution; it has been recorded only from lowland deciduous forest areas in Sonora and Michoacán. It appears similar to *P. caribaeus*, but is rather easily distinguished by its wing-angled branchlets, elliptic to obovate leaves, and hexamerous perianth.

REPRESENTATIVE SPECIMENS. SONORA: Mpio. Alamos, near Arroyo Potrero, 7 km ESE of Alamos, *Steinmann et al. 94-60* (DAV).—MICHOACÁN: Mpio. La Huacana, 29.8 km N of Descansadero, *Steinmann & Varela 1116* (DAV).

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